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Digital Augmentation of Keepsake Objects:
A Place for Interaction of Memory, Story, and Self

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S.B. Brain & Cognitive Sciences, Massachusetts Institute of Technology, 1995

Submitted to the Program in Media Arts & Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences
at the Massachusetts Institute of Technology

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Abstract

It is well, at certain hours of the day and night, to look closely at the world of objects at rest. The used surface of things, the wear that the hands give to things ... Let that be the poetry we search for ... [Neruda 1990]

This thesis explores digital augmentation of *keepsake objects* in order to enhance their inherent emotional value for an individual or community of individuals. I am defining *keepsake objects* as objects which hold personal significance to an individual. In particular, I will focus on their use as holders of stories, memories, and identity. I explore the nature and meaning of keepsake objects, in order to understand how best to augment their functionality as memory prostheses.

I describe the cognitive, social, and psychological aspects of one design implementation, Rosebud, which links children's stories to their stuffed animals. The meaning and value of a stuffed animal changes from a child's toy and friend to a keepsake object when the child is grown; Rosebud is designed to enhance the toy's value for both the child and the adult. Taking advantage of the story-evoking nature of stuffed animals, Rosebud is an interactive story telling system, which encourages children to express themselves. These stories are then stored with the toy, augmenting its keepsake nature.

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The implementation of Rosebud would have been impossible without the work of the undergraduates who struggled with me to make it a reality. First and foremost, I give thanks to Matthew Sakai: it's been one long year! Thanks as well to Tara Lee Andrews, Tony Gonzalez, Kartik Mani, Joy Nicholson, and Irene Wilson, for sticking with me through panicked last-minute sponsor demos, long weeks of user-testing, and hardware that had a mind of its own. I bet none of you will ever look at a stuffed animal in the same way again!

I would like to give thanks to Gesture & Narrative Language research group, with whom I made my home in the lab. In particular, I'd like to thank my two incredible officemates: Kris Thorisson and Obed Torres -- I passed many an hour discussing phi-

losophy and life with each of them. Also, thanks to Hannes Vilhajmsson, who did the wonderful Rosebud drawing of the sled leaning against the snow-covered wall, and Nick Montfort, who originally thought of the project title "Rosebud." Glen Sherman and Florence Williams, thanks for keeping things running smoothly and always being there to answer my millions of questions.

Many people at the lab outside of GNL have helped make Rosebud a success as well. Robert Poor, the designer of the iRX board, provided some of Rosebud's key technology and has been extremely helpful with our hardware problems. Linda Peterson I owe my sanity to, I would have never survived without Santina Tonelli or Laurie Ward, and how could I have gotten back into the Harvard Widener library this summer without David Riquier?

It would have been impossible to build a system for children without children to use it. In this regard, I am in debt to *The Computer Clubhouse* and *Harbor Point Youth Center.* With the aid of Gail Breslow, Stina Cooke, and the Girls' Day mentors, I was able to try out Rosebud in the learning environment of the clubhouse. With the aid of Eric Mitchell, Andrea "Reenie" Nunes, and Marguerite Maclean, I was able to set-up several computer and Rosebud for a week at Harbor Point during their summer camp. And tons of thanks to all the kids who used Rosebud: you guys were great!

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Mom. We've come a long way together. More than any other single person, you have shaped who I am today. With love, I dedicate this thesis to you.

Thank you. -jennifer

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CHAPTER 1

Scenario

Susan and Maria, eight year old girls, play with their stuffed animals all the time. Susan's favorite is Peanut the elephant; Maria's favorite is Purple the Platypus. They act out stories with Purple and Peanut, telling stories to with them and to them. The toys do not respond, but serve as an excellent focusing devices for their narrative play. One day, their friend, Jennifer, borrows Purple and Peanut and returns them with Rosebud software for the computer.

They sit down in front of the computer and start up the software. "Rosebud" says hello and asks who it's talking to. What are their names, ages, birth-dates, and favorite colors? The girls like "talking" to Rosebud, which remembers everything and personalizes to them. Rosebud then asks if they have any stuffed animals with them today. Susan holds her elephant up to the computer. Rosebud asks for its name, which Susan gives as "Peanut." Maria then shows her platypus and gives his name as Purple. Rosebud tells them that it likes elephants and platypuses and did they know that elephants live in Africa and India and Platypuses in Australia? It asks if Purple and Peanut are friends, and the girls reply, "yes." It then asks Susan and Maria to tell a story about Purple and Peanut. They're a bit shy at first and only write a couple of lines. Rosebud encourages them, saying that they don't have to be shy -- it wants to hear more! Realizing they have a willing listener, they start to write together a long story about how Peanut went to Australia on vacation and that's how he first met Purple.

When they finish, a light on Peanut's ear lights up and Rosebud asks them to read the story aloud. They take turns reading the sentences, with the other making appropriate sound effects in the background. They keep laughing and have to re-record it several times until they are both happy. The story and audio recording go into "Susan's & Maria's Storybook of Peanut & Purple." This book gathers all their stories, creating an archive of their development, which they'll later use to edit, add photos and drawings to their stories, put the stories on the web, play their audio recordings of their stories

to their parents, and print out the stories for their teachers and friends. The toy can hold the story, allowing the possibility of toy and story exchange among children, encouraging collaboration and sharing in the story development process.

In future interactions, Rosebud will recognize Peanut and Purple, and refer to previous stories Susan and Maria have written. It will ask about relationships between Peanut and Purple and Susan and Maria's other stuffed animals, encouraging the concept of a community of animals and allowing the girls to explore issues of social relations. Their stuffed animal friends listen to their stories, and remember them...

CHAPTER 2

Introduction

I begin my thesis with this introduction which gives the vision behind the work, the contributions the thesis makes, and then the personal motivation behind the project.

1. Overview

Picture an old teddy bear sitting on someone's shelf. It's missing an ear, most of its stuffing, and looks more like a rag than a stuffed animal. But it will never be exchanged for a new one, nor thrown out, because of its great sentimental value. It has personal and emotional significance, symbolizing someone's childhood and who they once were. I refer to such objects -- stuffed animals, photographs, souvenirs, heirlooms -- as keepsake objects. They are unique for their ability to hold memories and narratives from the past. Now imagine if you could pick up that old teddy bear and it could tell back to you all the stories you told it when you were growing up -- stories from when you were six, eight, twelve years old. What if it could tell you stories of your older sister, mother, grandmother?

Much research at the MIT Media Laboratory, as well as at other institutions, is focused on the digital augmentation of objects, moving computation outside of the traditional computer and into the everyday world. This research tends to focus on enhancing the practical or work-related value of objects, but digital technology can and should be used to also enhance the emotional and psychological value of objects.

> *The paradox I want to point out is that these objects which always have, in principle, a function, a utility, a purpose, we believe we experience as pure instruments, whereas in reality they carry other things, they are also something else: they function as the vehicle of meaning; in other words, the object effectively serves some purpose, but it also serves to communicate information; we might sum it up by saying that there is always a meaning*

which overflows the object's use.
[Barthes, as cited by, Gonzalez 1996, p.70]

Figure 2-1: Depiction of Sled from *Citizen Kane* (from *Absolut* advertisement)

Rosebud, the name of the project I'll be discussing, comes from the 1941 Orson Welles' film *Citizen Kane*. The film, a biography of the newspaper magnate, William Randolph Hearst, centers around the mystery of Kane's dying word, "Rosebud." Rosebud is revealed to be a sled from his youth, symbolizing the narratives and memories of his lost childhood. The final scene in *Citizen Kane* is a camera pan of a huge room overflowing with all the material objects Kane acquired during his lifetime. Lost among those objects, small and hidden, is the Rosebud sled, of more worth to Kane than all the expensive objects put together, because it was the key to his lost childhood. The loss of the sled symbolized his inability to regain the happiness of his childhood. It is the Rosebuds of the everyday world which I am digitally augmenting.

2. Contributions

This thesis is rooted in research in such fields as cognitive science, cultural studies, social studies, and anthropology, which were used as the basis for design and development of technology applications. A great deal of this work lay in understanding the relationship between theoretical research and implementation.

The result is three types of contributions:

- **Theoretical**: integration of human sciences with technology, to create a new field for development: computationally augmented keepsake objects, as well as highlighing the significance of both facets of objects, function and meaning, and proposing methods of enhancing the second.
- **Engineering**: design and implementation of the Rosebud system, a example prototype of such an augmented keepsake.
- **Empirical**: user studies with the Rosebud system, examining the use of digitally augmented toys by children.

I believe in the importance of the emotional and psychological value of objects, and as we move into the digital age, with more and more of our environment becoming computational, it is essential that we look at the impact this is having on the underlying symbolic meaning of the object. And, beyond that, when designing "things that think[1]," we should be enhancing both parts of an object: its function and its meaning.

This thesis looks at the humanist side of technology, and the psycho-social impact of our inventions.

3. Personal Motivation

3.1. My Protean Self

This work concerns the importance of voice and the notion that, traditionally, objective knowledge has been valued over experimental knowledge [Brown 1992], often silencing the personal story in the classroom. This graduate thesis uses both types of knowledge, presenting objective information, which will be situated with experiential stories, providing context, background, and understanding. I begin with my own story.

> *...the act of teaching, teachers' experiences and the choices they make, and the process of learning to teach are deeply personal matters inexorably linked to one's identity and, thus, one's life story. [Carter 1995, p. 327]*

"You are the first generation raised without religion." [Coupland 1994, p.161]

I am an only child, born to older parents. I lived in three states and some eight homes during my childhood, before my parents divorced. I was raised without a religion, hometown, or nuclear family. In many ways, I am "rootless." This allows for a "protean self" [Lifton 1993], a freedom of transformation, a fluidity to be anyone. I am not held by the traditions, expectations, or regulations of any place, person, or system of beliefs. On the other hand, there is a danger of fragmentation, of losing a sense of who I am. Where is my anchor in a constantly changing and shifting world, a world without any guarantees or absolutes? Where is meaning to life found in a decentralized world without a god?

"If we hope to live not just from moment to moment, but in true consciousness of our existence, then our greatest need and most difficult achievement is to find meaning in our lives." [Bettelheim 1996, p. 306]

Although not consciously, I became fascinated with the power of the object to provide stability and reassurance through its physical permanence and ability to symbolize the abstract.

While developing this thesis, I often contemplated my own cherished objects, which are few but highly meaningful to me and reflect my interest in the field. This thesis is, at its core, about objects highly personal to an individual. However, in describing the theoretical background, technical implementation, and so forth, it is easy to lose sight of the personal and what it means. I am, therefore, beginning my thesis with a per-

1. Term from Media Lab consortium.

sonal accounting of keepsakes, and I will end with personal stories of the use of the Rosebud system, so that at all times we remember the individual experience.

3.2. My Keepsakes

3.2.1. Mermaid necklace

When I was eight, my mother and I moved to Ohio, where she married an old friend, and I had a new home and family. For my first birthday spent with my mother and step-father, he gave me a gold pendant which he designed and had a jeweler create. It was a round pendant, with a diameter of about an inch and a half, and within it was a mermaid under two stars, pouring out water from a jug. He explained to me that it was a variation of my zodiac sign, aquarius, which is the giver of life (symbolized by water), and a sign often associated with hope, dreams, and the future. He gave it to me as a bond between a new father and daughter. That necklace became highly symbolic to me as a part of who I was: the link to my parents, the symbolism of the water-bearer, and the simple fact that it was a beautiful and unique design. I never took it off, although the chain was replaced some three or four times. By an outstanding coincidence, on the tenth anniversary of my step-father's death, the necklace was lost.

3.2.2. Father's watch

My step-father wore constantly a beautiful, classic watch. When he died, it went into a drawer with his other personal possessions, such as his wallet. When I was in college, my own watch broke and my mother asked me if I'd like his watch. I said yes, and when we took it from the drawer, we found the date on it to be the date he died. It is a self-winding watch, with the motion of the wearer's arm. When he stopped moving, so did the watch.

3.2.3. Rings

Lastly, I'll briefly mention the three rings I wear. First, my "brass rat," or MIT class ring, which symbolizes my intellectual achievement and marks my academic heritage. Second, a garnet ring, given to me by my mother when I was in high school. Lastly, after losing the mermaid necklace, my mother gave me an extremely tiny garnet ring which she gave me when I was very young. This I wear on a necklace. The baby ring around my neck and the full-size garnet ring on my finger create a continuum of time, and represents a history of love between my mother and myself.

All of these keepsake objects are pieces of jewelry, perhaps reflecting the need for something highly portable, because of my constant motion. The constant closeness to the body also imbues them with a special power. They each reflect a bond I have with another, in these cases, my parents.

3.3. How I Got Here

Although I only see the pattern in retrospect, I have explored memory and continuity during my six years at MIT.

It begins my freshman year when I took "The Psychology of Technology" under Professor Sherry Turkle. My final paper for the class proposed a concept of transitional objects for adults. I interviewed about half a dozen MIT students about their dormitory rooms and the objects in them, creating a model of people-object relations. My extracurriculars included working on the MIT yearbook, archiving the historical events of the previous year and photographing the campus, capturing the transience of undergraduate life. In one of my creative writing classes, my final piece was about a turn of the century photographer trying to capture his wife as she wastes away, dying of cancer. I majored in cognitive neurosciences, with my senior year research on the organization of human memory.

In both my academic and extracurricular activities, I have shown an interest in memory and preserving the past. This thesis reflects six years of college life looking for something important to me: a way to anchor my protean self.

CHAPTER 3

Motivation and Theoretical Framework

This chapter outlines the motivation for augmenting keepsakes in general, and provides the theoretical background for each of these motivations. I offer forth three main objectives, moving from general to specific: 1) to implement "tangible media" so as to better understand how the physical and digital worlds can be married; 2) to enhance the keepsake value of objects, so that individuals can merge the physical and digital worlds for establishing a sense of self and for self-expression; 3) to encourage story-telling and the establishment of voice in individuals. The following chapter will then look specifically at the system implemented, Rosebud, and give the background information particular to that case scenario.

1. Merging Physical and Digital Worlds

1.1. Tangible Media

Rosebud builds upon the design concept of tangible media [Ishii 1997], which includes the use of physical objects as part of the human-computer interaction. In [Ullmer and Ishii 1997], a comparison is laid out between levels of abstraction of graphical user

interface (GUI) icons and physical user interface icons (phicons). They describe four phicon levels:

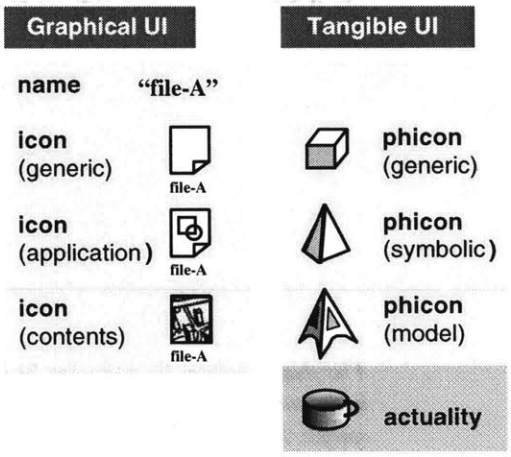

Figure 3-1: Tangible User Interface Continuum [1]

1) generic phicons (e.g. a box) which could represent any data; 2) symbolic phicons (e.g. a pyramid) which represent a class of data, such as geographic landmarks; 3) model phicons (e.g. a mini Eiffel Tower) which represent a specific data instance; lastly, 4) actualities (e.g. the actual Eiffel Tower in Paris), which represent themselves. Actualities do not have a graphical equivalent, because everything in the digital world is an image that represents. As Ullmer and Ishii point out, the Eiffel Tower is a highly inconvenient interface device; however, keepsake objects, by their size and nature, will prove to be ideal for such an interaction.

Actualities have several characteristics inherent in their nature which make them excellent as interface devices:

- **Meaningful container**: [Houde 1993] introduces the concept of "meaningful containers," where the container reflects the content. "The forms and containers of items that we interact with in the real world provide richer recognition clues than those on our computer desktops."

1. Diagram from [Ullmer and Ishii 1997]

- **Physicality**: The appeal to the haptic sense allows for an intuitive, natural, and comforting interaction [Druin 1987], permitting interactions such as holding, which are emotionally highly valuable. Secondly, their permanence allows maintenance of form through time, while simultaneously reflecting, in nicks and scratches, marks of usage and passage of time.

Rosebud furthers the design concept of "tangible media [Ishii 1997]," through application to a specific sub-set of objects, keepsake objects.

1.2. POEMs

POEMs, "physical objects with embedded memories," was a joint project between myself and Brygg Ullmer in the Media Lab Tangible Media group. It explored the use of physical objects as containers for relevant digital information. We partially prototyped a scenario with two objects, a seashell and book, and created a vision video to illustrate the concept.

1.2.1. Motivation and Scenario

POEMs questions the relationship between physical objects and digital information, and illustrates how objects might serve as place-holders for related information, in particular, how they could hold their own histories. We explored two forms of an object's history: *history of association* and *history of interaction.*

History of Association. Illustrated with the seashell, we looked at the association of the object through time with different people and locations. Most appropriate for objects important for their links to other people (e.g., gifts, wedding bands) or to locations (e.g., souvenirs), this approach views the object as an anchoring device for a grouping of memories, linked by place, time, and people.

Figure 3-2: POEMs Seashell Interaction

History of Interaction. Illustrated with the book, we examined how one individual interacts with an object through time, changing the nature of the object. This focused on the personalization of objects through the marking of objects. This marking is sometimes purposeful, such as carving initials into a wooden desk, and sometimes inadvertent, such as leaving a coffee stain in a book. These traces can serve as indicators of a history of interaction with that object giving usage patterns, and can provide clues about the person(s) associated with it.

Compare a book, just purchased from the local bookstore, with an identical book, owned by someone since they were in college. The second has been well-used, favorite pages dog-earred, a coffee stain on the page the owner was reading when his wife told him she was pregnant, an old receipt left in as a bookmark. The binding is broken and the book tends to fall open to the most read sections. There are parts underlined and notes in the margins. These traces, seemingly insignificant, yield a great deal of practical and emotional value. Markings such as where the books fall open to, dog-ears, highlighted lines, all give usage information. The reader can more easily find what they found most interesting, another can scan the book through the eyes of another. The coffee stain and an old receipt places the book into a history of the owner and it becomes a reminiscent object. Were this book lost, the new version would not provide the same level of information -- through time, the book has gained in value, at least to the owner, perhaps to others as well.

1.2.2. Results

Through creation of a vision video and a partly implemented prototype, Ullmer and I explored digitally enhancing or preserving histories of objects. We used the above

examples of a seashell and favorite book. We assumed the ubiquitousness of digital recording devices (still and video cameras, etc.), as well as a wireless world which can tag produced digital information with location, time, and persons in the vicinity.

The shell had bound to it all digital information with similar time, location, and people tags as those at its inception. This information could then be navigated through the manipulation of the shell -- through rotation along several axes, the photos and other data would be highlighted or dimmed, grow or decrease in size, depending on relevance.

The book had a digital twin which emphasized all pages with traces left by the user. Then, through manipulation of another version of the same book, one could see on-screen the notes in the margins and so forth. This allows a sharing of the traces.

The graphical aspect was prototyped with the 3wish language, and a Flock of Birds tracker is what traced the movement of the object.

Although POEMs met with great response, it raised many questions as to implementation of such a relationship between physical objects and their histories. In particular, POEMs relied on computer controlled decisions for what constituted as relevant information. Rosebud, as we'll later see, took the opposite approach, where authoring is in the control of the user.

2. Keepsake Objects

In order to make an object more powerful, we must have an understanding of the role that the un-augmented object plays. This is part of the motivation behind this thesis: how can one improve a keepsake object's ability to aid with social, cognitive, and emotional development (e.g., help with reminiscence, establishment of self-identity, security) by adding digital technology?

Every keepsake object is different, dependent on both its physical nature and its meaning to the individual. The first differs from class to class of objects, the second differs from individual to individual. (The following chapter tackles this second issue by looking at one type of keepsake object in detail.) It becomes difficult, therefore, to create design criteria for augmenting any and all types of keepsakes. Instead, what is helpful is to look at general characteristics and, from this, determine which more directly apply to the keepsake and individual in consideration, and how you want that keepsake to be augmented.

2.1. Power of the Keepsake Object

2.1.1. Protean Self

> *In order to understand what our possessions mean, it is necessary to recognize, reestablish, and reclaim [the magic of objects]. We more often than not wear magic clothes, jewels, and perfumes. We drive magic cars. we reside in magic places. We eat magic foods, own magic pets, and envelope ourselves in the magic of films, television, and books. We court magic in a plethora of material loci that cumulatively compel us to conclude that the rational possessor is a myth that can no longer be sustained. It fails because it denies the inescapable and essential mysteriousness of our existence.*
>
> *[Belk 1991, p.17]*

"...the things that surround us are inseparable from who we are...Therefore the things we make and use have a tremendous impact on the future of humankind." [Csikszentmihalyi 1981, p.16]

[Csikszentmihalyi 1981] emphasizes the importance of material objects as much more than merely tools. Humans, he says, through creation and interaction with the material world, are able to provide order and a framework of experience to their sense of self and establish identity. The nature of the material objects, therefore, affects the kind of person who will emerge.

[Lifton 1993] states that our sense of self is linked to history, and that many factors, including "dislocations of rapid historical change, the mass media revolution, and the threat of human extinction," breakdown of communities and authority, and decentralization of our world, have lead us to "evolving a sense of self appropriate to the restlessness and flux of our time:" the *protean self:* a "fluid and many-sided" person. This is a powerful image of self, but is subject to the danger of no "sustainable inner form," and fragmentation. [Lifton 1993, Kellner 1985] We see in popular culture our fear of this happening through the abstract digital world. For example, the heroine of 1996's movie "The Net" has her identity erased digitally, so that she no longer seems to exist.

Keepsake objects serve an essential role in anchoring the protean self. When belief in an ultimate truth, and perhaps even a god, is in question, and when absolutes are disappearing, there is an increased need for continuity. Augmented objects, such as Rosebud, can serve as focusing devices, allowing a person to reflect on who they are over time.

2.1.2. Identity in the Physical World

We actively surround ourselves with objects, which aid in the establishing of identity. This grouping of objects can be described as an autotopography, "an array of physical signs in a spatial representation of identity." [Gonzalez 1995, p.133]

We symbolically place parts of ourselves in objects. They are a physical embodiment of something otherwise abstract, and are able to serve as *lieux de memoire*, or memory space [Csikszentmihalyi 1981]: handles into personal histories and stories. They counteract the constantly changing world, revealing "the continuity of the self through time, by providing foci of involvement in the present, mementos and souvenirs of the past, and signposts to future goals [Csikszentmihalyi 1993, p.23].

I am defining keepsake objects as representative of self. Each object plays two roles: the narrative of the object with respect to the self, and the narrative of the object with respect to others [Dyl and Wapner 1996]. In the first case, the object serves a reflective role, helping to define oneself to one's self, and anchoring that identity. In the second case, the object serves a presentation function, painting an image of how one wishes to be seen [Goffman 1959]. In addition, each object can serve a role alone and in conjunction with other objects. [Gonzalez 1995, p.144] describes the narrative space attached to an object as:

"Without external props even our personal identity fades and goes out of focus: the self is a fragile construction of the mind."
[Csikszentmihalyi 1993, p.22]

> *... a series of unconnected associations that follow one from another, each aspect forming an image or meaning that rests in the mind without a plot -- a narrative fragment, a piece of signification that might make up a narrative were it connected with other bits and pieces ... The object functions as the material site for an already developed narrative to be grounded or condensed, or as a fragment of a larger narrative for which it serves as one trace among others.*

A keepsake object can represent the whole, or a part of the whole, such as a totem object [Dyl and Wapner 1996]. They can serve as mediators between two people [Dyl and Wapner 1996], as wedding bands do. Cinderella's shoe can be thought of as an enhanced keepsake object, with powers to bring together the two people it links. We tend to think utility first, but objects are also always signifiers.

2.1.3. Memory

"Remembering is like constructing and then traveling again through a space...Memories are built as a city is built."
[Umberto Eco, as cited by, Gonzalez 1997, p.122]

Proust differentiates between two types of memory:

- Intellectual memory: "an exercise of the will", purposeful
- Involuntary memory: caused by an external force, an object

The souvenir is the prototypical memory keepsake object, whose utility *is* its meaning, for they are purposefully created as memory objects.

> *The souvenir is not something which unexpectedly triggers memories from the depth of the past or the unconscious. The souvenir is destined from its very conception and, in*

> *some cases, fabrication, to become the memory site for a particular subject or group. [Gonzalez 1995, p. 131]*

Usually the functionally of an object is public knowledge, clear to any beholder of the object. A watch, for example, is for telling time. In contrast, the symbolic significance of an object is typically private, known only to one or a few individuals. That the watch was worn by her father is known only to herself and her mother. But this separation of the public and private begins to blur with the souvenir, because their function hints at their meaning, or because they have no function separate from serving as a souvenir (e.g., snow-filled globe).

> *The souvenir-space (walled garden, bedroom, ruelle, study or oratory) and the souvenir-object (book, flower, clothing, ring, ribbon, portrait, or letter) were quite private, having been possessed by an individual unique in time and space. Nevertheless, the significance of such spaces and objects was encoded and perfectly comprehensible to others. The source of meaning was social. [Ranum, as cited by, Gonzalez 1996, p.131]*

Souvenir:
"A remembrance, a memory; A token of remembrance; something (usually a small article of some value bestowed as a gift) which reminds one of some person, place, or event; a keepsake."
-Oxford English Dictionary

As [Gonzalez 1996] points out, the derivation of the word "souvenir," reflects both its physical and mental components, its origin from the French *souvenir*, meaning "memory, keepsake," and from the Latin *subvenire* "to come into the mind."

2.1.4. Identity in the Digital World

Having discussed how humans use the physical world to establish and maintain identity, I will now discuss how the digital world is similarly used. This will set the background for the next chapter where I will show how I have tried for computationally-augmented keepsake objects to use features from both worlds.

[Donath 1996], in exploring the role of deception of identity in Usenet newsgroups (structured bulletin boards on the internet), confronts similarities and differences between the physical and digital world with respect to presentation of self: "...in the disembodied world of electronic communication identity is problematic, floating free of the stable anchor that the body provides in the real world." [Donath 1996, p.1] She borrows from ethology, presenting two types of identity signals: 1) assessment signals, which are directly manifested from the trait (e.g., large muscles on a human are signals for strength), and are therefore expensive yet reliable, and 2) conventional signals, which are correlated with a trait, but there's no guarantee that the sender has the trait (e.g. wearing a "Gold's Gym Powerlifter" t-shirt), so are less expensive and less reliable. The digital world also has both types of signals, from domain names in email addresses to homepages. "From the header to the signature, identity cues are scattered through-

out the Usenet letter, from declarations of one's name, age, sexual orientation, to the subtler 'expressions given off' through voice and vocabulary." [Donath 1996, p.18]

While Donath asks about digital *expression* of self, [Turkle 1984] asks how computer technology has affected *establishment* of a sense of self. She describes the computer as an "evocative object," showing how children use machines to change their classifications of living versus non-living things, as well as creating a unique definition for human beings. The computer challenges the definition of what it is to be human, not only for Turkle's young subjects, but for adults as well. In the age of IBM's Deep Blue[1], many ask what the characteristics are which make humans unique.

Donath and Turkle are exploring how the digital world is changing our conceptions of identity. In a series of personal interviews I conducted in spring of 1997, I talked to MIT graduate students about how they establish identity, in both the physical and digital worlds. Their answers illustrate integration of both worlds into their conceptions of self.

Brian and Michael[2], two of the students interviewed, both have a sense of the importance of the physical objects in their world, discussing the importance of, respectively, their quilt and undergraduate class ring, but they are children of the digital age. They no longer only live in the physical world and no longer do they only have physical bodies. Brian does not center his sense of self in his home or his school; rather than a physical landscape of memories which anchor his identity, he has a digital landscape of memories:

> *Everything I had was on the net. I could get to ... all my old papers. I could get to things I wrote in 7th grade ... [During this six year period], almost none of that time was I within a ten-mile or even hundred-mile radius of that machine, but that was sort of where I lived, in this computer in South Carolina.*

Similarly, Michael dissociates himself from the physical world and dependence of physical objects. He denies the attitude of collecting, but in the same breath, describes how he collects digitally.

> *This whole attitude of collection, of collecting things that mean something. Almost doesn't work for me, because I know in some sense they're just physical things ... What's more important to me are the memories associated with them. For example, in the virtual world, I've been collecting all my email for years. That's really exciting to me because fifty years from now, when I look back, I'll actually be able to see what were my*

1. The first computer to beat the world's presiding human chess champion.
2. All names have been changed.

thoughts, what were other people's thoughts ...

"Identity today thus becomes a freely chosen game, a theatrical presentation of the self, in which one is able to present oneself in a variety of roles, images, and activities, relatively unconcerned about shifts, transformations, and dramatic changes." [Kellner 1985, p.158]

As we inhabit these two worlds, one physical, one digital, so do we establish and express our sense of identity in both places. The digital world is a new arena of expression, with new metaphors and a new language to learn: "The virtual world's subcultures have developed their own patois, with codes and linguistic patterns that identify affiliated participants." [Donath 1996] It has capabilities that the physical world does not, which can allow new expressions of self. It allows identity presentation divorced from the body, which therefore allows expression independent of gender, race, nationality, and physical characteristics. In consequence, there is room for exploration that the physical world cannot provide. It is a networking of the world, allowing near instantaneous communication and publication with the entire world. It is multimedia, allowing expression through a collage of sounds, images, and video. Its most striking, and dangerous, component is its fluidity, and our digital selves are Protean selves, fluid and of many forms, not confined by space or time. It is the postmodern self, where there's "no individual essence to which one remains true or committed. One's identity is continuously emergent, re-formed, and redirected..."

> *If I can speak directly or by electronic mail to a friend in Paris while sitting in California, if I can witness political and cultural events as they occur across the globe without leaving my home, if a database at a remote location contains my profile and informs government agencies which make decisions that affect my life without any knowledge on my part of these events, if I can shop in my home by using my TV or computer, then where am I and who am I? In these circumstances I cannot consider myself centered in my rational, autonomous subjectivity or bordered by a defined ego, but I am disrupted, subverted and dispersed across social space.[Posner 1990, p.15]*

The digital world, a place defined by its "refresh rate," is by definition, always changing. If we wish to use digital technology to enhance identity, there is advantage in appealing to the physical to bring that which the digital world does not have: permanence.

2.2. Defining Keepsake Objects

[Webster 1992] defines *keepsake* as "something kept or given to be kept as a memento," and lists as synonyms: "remembrance, memento, memorial, relic, reminder, souvenir, token, trophy." It is formed from two parts: "keep" as in to "preserve, maintain" , and "sake" as in "end, purpose,"[1] with a combined meaning of something with the purpose for keeping. I have appropriated this term to create a class of items which I refer

1. Webster uses the illustrative example: "for the sake of argument."

to as "keepsake objects." By my definition, they are a subset of what psychology refers to as *cherished possessions*: "objects belonging to an individual which are considered 'special'." [Dyl and Wapner 1996] Cherished possessions can include electronic equipment, cars, pets, etc. They are one component of a field of psychology which studies objects as mediators between the self and the environment, starting with [Winnicott 1971]'s *transitional object*, a child's first "not-me" object. Keepsake objects are distinct from the broader class of cherished possessions in that they are objects kept over time ("keepsake" versus "cherished"), and the value inherent to them is rooted in their irreplaceability and the personal history associated with it. A keepsake object, if lost, cannot be replaced. Certain objects have a greater tendency to become keepsakes (e.g. heirlooms, souvenirs), but almost any object (e.g., a lace handkerchief) can become one. In contrast, a cherished object may be valued for its monetary value or the function it serves (e.g., clothing), and if replaced with identical items, would be just as cherished.

Cherished object research has explored the effect of such objects on cognitive, social, emotional, and identity development, including developing significant classification systems of the objects. [Dyl and Wapner 1996] describe one such schema, based upon [Csikszentmihalyi 1981], which includes categories for the nature, meaning, and functions of cherished possessions, with emphasis on younger persons.

Here I am outlining some of this work, highlighting the characteristics which are most relevant to keepsakes in particular, and elements which are important to this research.

2.2.1. Keepsake Characteristics

[Dyl and Wapner 1996] describe the role that cherished possessions play in four areas of development: cognitive, identity, emotional, and social.

- **Cognitive Development**: As stable anchors, they can help with the exploration of new environments. They can also be cognitive links to the past, present, and future.
- **Identity Development**: They aid with a sense of self, for such objects are viewed as part of the self through "controlling the object's use, by recognizing the importance of one's self to the giver, and by knowing the object itself." [Sartre, as cited by, Dyl and Wapner 1996, p.34]
- **Emotional Development**: The most emphasized emotional function is security, satisfying needs which humans do not, and giving control over an object.

- **Social Development**: Children use objects in group play, leading to shared experiences with others. They also play a role in social comparison and competition with peers.

They then outline the many potential functions which cherished possessions can serve. In this case, only a portion of the functions are of interest to this research. Functions are split into two primary categories: 1) person, and 2) non-person. For *person*, there is another split into 1) self, linking possession to self, and 2) other, linking possessions to friends, immediate family, and relatives. For *non-person*, the split is between 1) past experiences, such as memory objects, and 2) present-future experiences, such as enjoyment or monetary value of the object. Of particular importance to keepsakes were the five sub-categories under Past Experiences [Dyl and Wapner 1996, p. 351]:

- "Memento ('It reminds me of my Grandmother who died')
- Recollection-- of a specific occasion ('It reminds me of last Christmas')
- Heirlooms ('It's special because it was passed down from by Grandfather')
- Souvenirs -- memory of a place
- 'Had for a long time'"

Also of particular interest to this thesis was [Dyl and Wapner 1996]'s classification of the changing meanings and functions of possessions, with respect to age and gender. To summarize their findings, children use their cherished possessions for play, security, and companionship. As they grow older, males tend to emphasize the action items, while females concentrate on contemplative and reflective objects. In addition, females were more interpersonally oriented, favoring communication items, while males were more instrumentally oriented, preferring equipment and games.

2.2.2. Conclusions

I have just outlined the many advantages of the physical world, such as constancy, tangibility, and the adding of traces over time. Yet the physical world also has disadvantages for which the digital world as compensate. Sharing of information and distribution through a network are not possible with solely physical objects. They take up space, cannot always be easily transported, and exist in one original form which can be lost or stolen. Unaugmented keepsakes are dependent upon human memory which is notoriously fickle and unreliable. Traditional keepsake devices can't merge or easily become multimedia -- photos, video, souvenirs, all remain separate. Lastly, one can't merge physical and digital selves.

Computationally augmented keepsakes aims to combine the strengths of both worlds, keeping the tangible, physical artifact, but adding to it the stories and memories which can be accessed and altered digitally. In doing so, we are creating a new device for self-expression, which will encourage personal storytelling.

3. Giving the Voiceless a Voice

> *Objects affect what a person can do, either by expanding or restricting the scope of that person's actions and thoughts. And because what a person does is largely what he or she is, objects have a determining effect on the development of the self, which is why understanding the type of relationship that exists between people and things is so crucial. [Csikszentmihalyi 1981, p.53]*

As the above quotation states, objects can expand a person's capabilities, and in this case, that ability is to be heard. Digital technology, with the personal computer's empowerment of the individual and the internet's networking of the world, lends itself to this agenda, provided that the voiceless are encouraged/enabled to use it. The counter is that it can become solely a tool of those already heard, and the voiceless are left voiceless. Without a public voice, a person cannot be heard, and if a person is not heard, they cannot influence their world, but rather are at the mercy of those around them [Lewis 1993, Freire 1970]. For a fully free society, it therefore becomes essential to cultivate a world in which all voices can be heard and none are silenced. In addition to that, it is necessary to teach those who before have not spoken, how to speak. These two agendas are mutually dependent, for what is the point of a world where everyone listens, but few speak? And what is the point of teaching the silent to speak if others do not listen?

Giving voice results in a distribution of authority, a decentralizing of power. [Resnick 1994] describes human society as moving away from a "centralized mindset," with a strongly held belief in centralized control and the need for a leader, and moving into an era of decentralization. He outlines five areas in which this trend can be observed: 1) organization, which are flattening out hierarchies of power, 2) technologies, such as the superseding of the super-computer with the personal computer, 3) scientific models, which are leaning more towards complex ecosystems, and less towards casual chains, 4) theories of mind and self, Minsky's "society of mind," and 5) theories of knowledge, which are moving away from belief in a single objective truth to the idea of multiple voices and multiple truths, termed "epistemological pluralism." [Turkle 1984, Papert 1996]

Likewise, we should be designing software that moves away from centralized control in the designer, and gives control to the user [Cassell 1997], in the same way that traditional print media has moved away from authority centered in the author:

> *It would not be an exaggeration to say that the nouvelle critique has been an egalitarian revolt against the authority of the writer and the book in the name of the reader and reading. Where once authors were considered geniuses inscribing truth in great works of art, they now are declared to be dead. Where great books were thought to embody precise and autonomous meanings, radical critics have declared books empty of meaning in their own right. Freed of the restraints of 'authoritarian' authors and texts that control their own meanings ... readers may now give their own interests and imaginations free rein. [as cited by, Jenkins 1992]*

The computer is unique in its high level of potential flexibility: it can be used as a tool for almost any sort of enterprise. What is necessary is that users realize this and that they are encourage to adapt their computer to fit their desires and needs.

This personalization or appropriation of the materials we're given is how we express ourselves, and is how the dominant rhetoric is often countered. [Jenkins 1992], studying the fandom culture of Star Trek, refers to deCerteau's concept of "textual poaching:" taking from readings what one wants for one's own use. The reader takes possession and control over the meaning of a text. This counters the traditional hierarchy of authorial meaning over reader's meanings, where the authority and power lies with the producer, not the consumer. When only one reading is allowed, such as in some educational philosophies, teachers' authority is protected, but alternative interpretations and voices are denied:

> *This respect for the "integrity" of the produced message often has the effect of silencing or marginalizing oppositional voices. The exclusion of those voices at the moment of reception simply mirrors their exclusion at the moment of production; their cultural interests are delegitimized in favor of the commercial interests of authorized authors.*

Sanctioned readings creates a right and a wrong, and schoolchildren become passive recipients, and their "personal feelings and associations are rated 'irrelevant.'" Appropriation is a move towards decentralization and the support of multiple voices. We need to encourage this appropriation, personalization, and alternative readings through the building and designing of technologies, toys in this case, that will allow this. Through these methods, multiple voices, including minority and marginalized voices, can find a space to be heard.

This chapter began by looking at tangible media, a potential new arena for self expression. By applying tangible media to keepsake objects, a traditional realm for personal expression, an opportunity arises to encourage individual voices in a manner previ-

ously not possible. The combination of intensely personal keepsakes, which are individual owned and controlled, with digital technology, which allows immediate "publication" on the internet, can allow one to be secure in expressing themselves and then to share that voice with the world.

CHAPTER 4

Context for the Rosebud System

In the last chapter, I explained the motivation and gave background for augmenting keepsakes, irrespective of the specifics. In this chapter, I will give the background necessary for one scenario: augmentation of a child's stuffed animal. Then, in the next chapter, I will look at the design choices made in implementing the system.

1. Stuffed Animal as Keepsake Object

My motivation has been laid out as finding, in the space where physical and digital meet, a new place for interaction of memory, story, and self. This requires an understanding of the physical object's affordances which allow it to serve as a prosthesis for memories and stories, and therefore, identity.

The Rosebud system uses the stuffed animal as the keepsake object. Therefore, we will first look at the characteristics unique to stuffed animals which will make it powerful as a digitally enhanced keepsake. The design process then focuses on strengthening these characteristics.

First and foremost, the stuffed animal is a child's toy. It is unique as a toy in that:

- It's anthropomorphic nature allows the object to share, in an active role, the social experience.
- It is a story-evoking object, not just for memories for the adults, but fictional narratives as well, serving as a creative prop for children's developing imaginations [Goldstein 1994, Sutton-Smith 1896].

- It is a gender-neutral toy, appealing to both boys and girls [Asakawa and Rucker 1992].

These features will allow us to create a social, interactive, gender-neutral story-telling system.

Secondly, the stuffed animal is a toy that often is kept by adults as well. Interaction styles with them change over time, and the value of a stuffed animal changes with age [Dittmar 1991]. While to a child, it is a friend, someone to tell stories about, with, and to, to the adult, it holds the stories they once told and now retell in a new way, with nostalgia.

Stuffed animals, in general, are probably the most likely object from childhood to be kept and to become a keepsake for the adult. "Soft toys were constant companions, much loved and not easily given up, often even in later years." [Sutton-Smith 1986, p.47] It is difficult to give up the friend who was always there for you, even if that friend is made of fluff.

[Sutton-Smith 1986], in intensive interviews, questions the role of soft toys in the lives of adults.

> *Some report keeping the stuffed animals from each stage of their life, as current collections which serve as reminders of their own emotional biography. In childhood it might be a teddy bear; but in adolescence would be "humongous" stuffed animals that were won for them by boy friends, and later "political" animals given by adult friends. [Sutton-Smith 1986, p.47]*

[Sutton-Smith 1986] quotes one women from his interviews who created an autotopography solely out of her stuffed toys:

> *Although I did not really have very many important stuffed animals when I was little, I find that I do have several stuffed toys around my apartment now. They have arrived, this cast of goofy characters, in varying stages of the unfolding of my inner life. It is almost as if I have found a comfortable, safe way to physicalize the inner, symbolic ritual of 'regressing' to an earlier, freer state of being.[Sutton-Smith 1986, p.48]*

We are taking an object, the stuffed animal, which already has meaning for us, and which we already understand how to use, and expanding on its inherent storytelling capabilities through computer technology.

The child naturally uses stuffed animals to evoke stories, and the adult naturally uses the stuffed animal as a memory prompt. By creating stories of their own, children find their own voices, and therefore, their selves. When the children are grown, the telling of those stories will become memories which will form the foundation of identity.

In order to understand where Rosebud fits into a larger socio-historical perspective, I will look at the history of how children establish who they are, and the role children's toys (particularly stuffed animals) and stories play. Lastly, I will give the philosophical, political, and educational context for the designing of Rosebud as a child's toy to help give children voice.

2. Storytelling

Storytelling does two things: it teaches storytellers about themselves and about the socio-cultural context in which they live, and it makes them better communicators through practice and feedback. Rosebud is an interactive story system that encourages both of these forms of learning.

Objects, such as childhood toys, have rich associations with them, and can serve as a starting point for telling stories and for self-exploration. Children begin storytelling orally, and the use of a stuffed animal as a creative prop is common [Goldstein 1994]. Yet the stories from this spontaneous and prolific form of storytelling are usually immediately forgotten and the chance to build upon them is lost. Rosebud is intended to help children progress from oral to written storytelling, using the stuffed animal as a link between the two. The solitary nature of written storytelling, in contrast to oral storytelling with external prompting and the stimulus of others, can be discouraging. With Rosebud, the computer is the listener.

Studies of emergent literacy in children indicate that the features which differentiate oral from written storytelling, such as contextualization, fragmentation (uncompleted sentences, interruptions, over-use of conjunctions such as "and" and "and then"), and improper use of pronomials, are challenges in the acquisition and development of written language [Peterson and McCabe 1996, Martlew 1986]. Rosebud has a cognitive and educational goal of improving children's storytelling skills by developing a storytelling system which looks at the user's stories for these common mistakes, and through feedback, modeled after parental scaffolding [Martlew 1986], works with the child to fix these mistakes. The design of this computer-aided editing and revision system is primarily the work of [Sakai 1997].

Stories and narrative, whether personal or fictional, provide meaning and belonging in our lives. They attach us to others and to our own histories by providing a tapestry rich with threads of time, place, character, and even advice on what we might do with our lives. The story fabric offers us images, myths, and metaphors that are morally resonant and contribute both to our knowing and our being known. [Witherell and Noddings, as cited by Lewis, 1993, p.1]

3. Children's Voices

What is the power for children of having their stuffed animal friends come to life? I propose that, to no small degree, it provides a listener to the child, much like an imaginary friend. When the children are hushed or not listened to by their parents and teachers, they find a new outlet in their toys which, in their minds, come to life and provide confirmation of their alternative world. "They listen attentively for hours, when no one else seems to want to."[Publicity release, as cited by Sutton-Smith 1986, p.44] In my user studies interviews, I asked children "If you could make your stuffed animal do anything, what would you want it to do?" The universal answer was "talk to me."

Our image of the child is an adult construction. [Rose 1984] describes the "impossibility" of children's literature, in which no child exists other than the one the adult author has created. Through children's literature, toys, and media, adults create an identification child, which they have control over and which they hold children up to. "What the child *is* matters less than what we *think* it is."[Kincaid 1992, p.62] The challenge adults face in creating for children is to give them what they want and need, not what we want them to have or need them to be. Doing so brings forth the child outside of adult constructs, resulting in adults' loss of control of the child, which is difficult to relinquish. However, while we believe in our own constructions, we deny children's voices. We don't hear what they're saying they are or what they want. We must learn to listen to children and consider what they say as important as well.

3.1. Children's Material Culture

By defining the child, we control the child, and the child is defined through such mediums as children's literature, toys, television, and movies. It is here that the child is concocted and enforced.

Appropriation of children's toys by adults for such manipulation has its roots in John Locke who first proposed teaching children through play. The doll is the canonical example of molding children, in this case, girls, through their play objects. Although the intended function of dolls has changed over time, in every case, it was to teach girls how to be what their parents thought girls should be. In antebellum America, dolls were for teaching practical mothering skills. This later changed to encourage emotional bonds and feminine socialization skills. Dolls were often made of porcelain, so that girls were forced to be gentle and delicate[Formanek-Brunell 1993].

In contrast, children's literature was created as a medium to teach children moral lessons and would become a tool of socialization. In the late 18th and early 19th centuries, girls and boys books had not yet been separated and the lessons they taught to both were of "obedience, submission to authority, and selflessness."[Segel, p.167] Later, girls books would teach girls obedience, while Tom Sawyer would become the ideal boy child, defying authority.

"Meanings from both inside and outside the artifact and traverse the boundaries between them." [Rand 1995, p.101]

Although adults control what enters the child's world, creating their toys and books, children are not passive recipients. Rather, they rebel in all manner of ways. When designing for children, it is important to understand that the designer's intent does not necessary match the consumer's use.

One well-documented example of such rebellion was girls' funeral doll play, where rather than enacting their dolls' marriage or mothering, the girls would enact elaborate funerals of their dolls, literally and symbolically killing what the doll represents. As [Formanek-Brunell 1993, p.8] describes such activities:

> *[It] challenged parental authority, restrictive social customs, and gender roles. Girls in the process of constructing their own notion of girlhood engaged their parents in a preconscious political struggle to define, decide, and determine the meaning of dolls in their own lives and as representations of their own culture.*

"The boy's investment in the toy will give it a meaning that was unanticipated by the toymaker, a meaning that comes not from its intrinsic merits or economic value but rather from the significance the child bestows upon the commodity through its use." [Jenkins 1992, p.51]

Children don't want to be defined, and will creativity and persistently find ways to counter adult mores and the image adults place on children. The result is appropriation of the adult-designed toys and adult-written books, or fascination with that rejected by the adult world, such as scatological references, or "ket" candy.

[James 1982] analyzes the role of "ket" candy in children's denial of the adult order. The word "ket" has its origin in such definitions as "useless, rubbish." It was something thrown away by adults. Children appropriated this word to apply it to a particular type of inexpensive sweet which is highly desired among children. Everything about kets counters what adults find appealing in candies. They are given names such as "Fizzy Bullets" and "Car Parks", they are all sorts of un-natural colors such as

bright blue and yellow, they are messy to eat. Through ket, children develop an alternative society, with their own ordered system of rules. "For children, 'kets' are an important vehicle for defining the self."

Appropriation and transformation of meaning by children should be encouraged, and designers have an opportunity to do so by designing toys which leave room for the child's own interpretation and personalization. [McLuhan and Zingrone, 1995] describe Marshall McLuhan's differentiation between a "hot" medium, such as the radio, and a "cold" medium such as the telephone. A hot medium has a lot of prewritten data, whereas a cold medium relies upon the user to fill in the information. By allowing children to be active participants in the creation of their identity and their world, we are allowing them voice which is "...crucial for both the maintenance and continuation of the child's culture and for the growth of the concept of the self for the individual child." [James, 1979, p.295]

3.1.1. Stuffed Animals

The soft toy, or stuffed animal in particular, is a prototypical cold media children's toy. Through its softness and anthropomorphic nature, it offers itself up as a personality which the child has complete control over. Children take advantage of this and bring their toys to life with stories and relationships between stuffed animals.

The stuffed animal serves particularly well the role of toy for consolation in loneliness -- as a friend. They are often the classic transitional object [Winnicott 1971], such as Linus' blanket, and [Sutton-Smith 1986] describes blankets and teddy bears "...as a general response to the loneliness and search of substitutes brought about by the increasing solitariness of children during the past several hundred years." He hypothesizes that the toys which are the best substitute friends are those with the most humanoid characteristics, such as toys with faces, with voices, or which react.

In all forms of children's media, adults write of children imagining their stuffed friends coming to life. To use recent examples, in the past couple of years popular children's movies have included *Toy Story* and *The Indian in the Cupboard.* Winnie-the-Pooh is an enduring classic (now a popular television cartoon), and Calvin and Hobbes one of the most popular comic strips. [Rostow-Kuznets 1994] has covered the long history of such animations.

In the previous section I discussed the relationship between adult intent and children's reception. Here I discuss briefly a couple of examples from the literature of toys com-

ing to life, to show the role the stuffed animals are portrayed in by adults. While children can and do appropriate, adult influence still plays a role and should not be ignored.

Figure 4-1: A.A. Milne, Son Chistopher Robin, and the Original Winnie-the-Pooh

Adult Depiction of Stuffed Animals. Adults seem to have as much fascination with stuffed animals coming to life as children do. A.A. Milne and Bill Watterson have created two of the best known "toys come to life:" Winnie-the-Pooh and Hobbes from the comic strip Calvin and Hobbes. Both acknowledge the stuffed nature of their subjects, Milne in the Winnie-the-Pooh song ("Tubby little cubby all stuffed with fluff...") and Watterson by drawing Hobbes differently according to whether there are others around. When Calvin and Hobbes are alone, Hobbes is drawn as an animated, real tiger. When others are around, he's drawn as a stuffed toy. Several strips show Calvin's flexibility of mind when his imagination's world conflicts with the real world, like when he believes Hobbes can throw a water balloon at Susie, but she merely takes it from the stuffed toy instead (see strip 1), or how the real world can confirm his beliefs, such as when he brings Hobbes to school to fight the school bully (see strip 2).

Figure 4-2: Calvin & Hobbes, Strip One [Watterson 1990, p. 38]

We're abandoning this life we've led!
So long, Mom and Pop!
We're sick of doing what you've said,
And now it's going to stop!
We're going where it snows all year,
Where life can have real meaning.
A place where we won't have to hear,
"Your room could stand some cleaning."
We'll never have to go to school,
Forced into submission,
By monstrous, crabby teachers who'll
Make us learn addition.
Oh, what a life! We cannot wait,
To be in that arctic land.
Where we'll be masters of our fate,
And lead a life that's grand!
No more of parental rules!
We're heading for some snow!
Good riddance to those grown-up ghouls!
We're leaving! Yukon Ho!
[Watterson 1989, p.1]

Figure 4-3: Calvin & Hobbes, Strip Two [Watterson 1990, p.80]

For both authors, the toys are the children's best friends, always there for them. Pooh is the classic friend and comforter, always there for Christopher Robin, and serving as a listener:

> *So wherever I am, there's always Pooh,*
> *There's always Pooh and Me.*
> *"What would I do?" I said to Pooh,*
> *"If it wasn't for you," and Pooh said: "True,"*
> *It isn't much fun for One, but Two*
> *Can stick together," says Pooh, says he.*
> *"That's how it is," says Pooh.*
> *[Milne 1992]*

Interestingly, Calvin's constant companion is also his buddy facing the evil adult world of parents and teachers. Through Hobbes, Watterson describes Calvin's frustration at his lack of control over his own life, and being forced to follow adult rules and regulations. This is no more clearly expressed then with "The Yukon Song" (see margin).

Figure 4-4: Calvin & Hobbes, Strip Three [Watterson 1990]

Both in observing children and in adult depiction of children, they show great flexibility with their stuffed friends, using them to suit their needs. In addition, children use them as an audience to their hopes and fears, and as a way to fight back against the adult establishment. Such a toy, therefore, is an excellent device for encouraging children's voices, and can be enhanced as such.

4. Listening to Children

I began with Rose's statement that the child is an adult construct, and discussed how adult's use children's literature and toys to mold children into their conceptions. I then countered that with a description of the power of children's appropriation, and lastly, I reviewed this child-adult relationship in reference with to the stuffed animal. However, this battle over children's voices and identity goes beyond children's material culture and also concerns relationships in the school and home.

In reference to socio-political power, children have been compared to women and minorities:

> *. . . children are denied direct access to legal and social institutions; not permitted to decide their own fates; expected to defer to the preferences and judgments of the upper class (adults) and denied specific privileges reserved for the upper class, such as self-determined bedtimes, use of social drugs, and the right of free association. We live under the assumption that children are especially privileged and that our entire culture is child-centered, but the romantic mythology encrusting childhood is very much like that used for racial and gender power-moves: children, colored, and women are all depicted as naturally carefree, fortunate to be unsuited to the burdens of autonomy and decision-making, and better off protected by those in control. [Kincaid 1992, p.64]*

Post World War II saw a change in the attitude towards child rearing, captured by Dr. Spock's *Guide to Child Rearing*. Following the war, there was a boom in marriages, followed by the baby boom. Parents were young, on the corporate track and living in suburbia. There was the rise of the nuclear family, and the breakdown of the extended family. With young parents living far from their parents, they were in search of advice on how to best raise their children [Jenkins 1997b]. *Guide to Child Rearing* was a paperback, written for the average person, and became one of the top selling books in the world. It introduced permissiveness, a mapping of political and social orders onto child rearing. Whereas children had been previously raised in an autocratic environment, with a strong power hierarchy, discipline, punishment, permissiveness encour-

aged a democratic family environment, where the children participate and have a voice, with agreement, negotiation, collaboration. This was a dramatic rethinking of parent-child power relations.

Accepted interactions with children were changing in school as well as in the home. John Dewey, the educational theorist, proposed a new utopian educational philosophy, "progressive education," which he contrasted with "traditional education."

We must not think of a child's mind as of a vessel, which it is for us to fill, but as a wonderfully organized instrument, which it is for us to develop and set in motion. [Kincaid 1992, p.66]

Traditional education uses a model of transmitting bodies of information to docile, passive, and receptive students. Progressive education emphasizes the "freedom of the learner," and instead of relying on the subjects, it relies on the interest of the students. "The traditional scheme is, in essence, one of imposition from above and from outside. It imposes adult standards, subject matter, and methods..."[Dewey 1938, p.18]

Instead of imposition from above, a hierarchy of knowledge and power, Dewey says,

> *...in what are called the new schools, the primary source of social control resides in the very nature of the work done as a social enterprise in which all individuals have an opportunity to contribute and to which all feel a responsibility. [Dewey 1938, p.56]*

This increased freedom in the classroom allows for "free play of individual thinking" and "contributions due to distinctive individual experience." In Dewey's progressive schema, children's voices in the classroom are heard and they make a difference.

4.1. Designing to Encourage Children's Voices

Some adults have acknowledged children's voices as voices in their own right and cater to this belief. Nickelodeon, for example, is designed around children's voices, such as having children be the reporters on the news shows. However, probably the most well-known example of writing to encourage children's voices is Dr. Seuss.

Dr. Seuss, a propaganda writer during World War II, before writing children's books, believed strongly in the power of children to change the world, and the need to practice with children the political systems we purport to support.

> *Children's Reading and Children's Thinking are the rock bottom base upon which the future of this country will rise. Or not rise. In these days of tension and confusion, writers are beginning to realize that Books for Children have a greater potential for good, or evil, than any other form of literature on earth. They realize that the new generations must grow up to be more intelligent than ours... He can help children to think-*

> *ing clearly. Or He can stuff their heads with mush. He can inspire children with a fire for learning. Or he can discourage them from reading and contribute to their illiteracy, and often, to their delinquency. He can help them to love. Or he can help them to hate...[He] can build in them basic attitudes towards living that will influence their patterns of thought and action throughout every year of their lives.[Dr. Seuss, as cited by Jenkins, to be published, p.1]*

"Horton Hears a Who" is a analogical telling of children's voices not being heard, but, in the end, it's the smallest voice of all that makes the difference. As [Jenkins, unpublished] says, "Seuss's focus on the 'small' ... represents an appeal to children who feel overwhelmed by the adult world and need to find their own voices."

The story begins when Horto the elephant is splashing in a pool and he hears cries from what looks like a dust speck. He realizes that there are really small people living there and that they might land in the water:

> *Some poor little person who's shaking with fear*
> *That's he'll blow in the pool! He has no way to steer!*
> *I'll just have to save him. Because, after all,*
> *A person's a person, no matter how small.*

The other animals in Horton's community then begin to make fun of him, not believing there are people on the dust speck. They then get aggressive and take it away by force and try to hide it. When Horton finds it, they use violence, threatening:

> *You're going to be roped! And you're going to be caged!*
> *And, as for the dust speck...hah! That we shall boil*
> *In a hot steaming kettle of Beezle-Nut oil!"*

In order to rescue the little people, Horton asks them to make as much noise as possible so that the other animals (with not so keen of hearing as an elephant's) can hear them and believe in them. All of the little people make lots of noise except for one who's quietly playing with his yo-yo instead. And with his voice, *"Their voices were heard!"*

From this parable we get a picture of children as without control of their own lives, subject to the mercy of the wind and forces they don't understand and in need of protection. But, even more importantly, we see the need to listen and to hear them and, to believe in them, as Horton said, "I believe in you all!" The adults, on the other hand, when not understanding something, attempted to destroy it, giving a negative message towards such rule and control. In the end, the smallest little person made the difference: "And their whole world was saved by the Smallest of All!"

"Just because we're kids, because we're sorta small, because we're closer to the ground, and you are bigger pound by pound, you have no right, you have no right to push and shove us little kids around."

Through awareness, I can purposefully, rather than unintentionally, affect children, including designing to encourage children's voices. Others have taken such an approach, such as the educational philosophy of constructionism [Papert 1996] and its instantiation in the programming language of LOGO, Amy Bruckman's MooseCrossing where children create their own space, or [Umaschi 1997]'s SAGE which allows children to build their own storytellers.

5. Other Voices

> *...help create a space for mutual engagement of lived difference that is not framed in oppositional terms requiring the silencing of a multiplicity of voices by a single dominant discourse.[Lewis and Simon, as cited by, Lewis 1993, p.68]*

I've already discussed children's voices, and I will now discuss two other, not mutually exclusive, groups which are trying to find a voice and are trying to find a place to be heard: girls/women and the underprivileged classes. I have designed the Rosebud system with access and empowerment issues for these groups in mind.

5.1. Women's and Girl's Voices

Keepsake objects aid in the expression of identity, and gender is one important aspect of that identity. Using a computationally enhanced artifact to express identity brings up, but can also help to negotiate the tension in the relationship of boys and girls to technology. [Turkle 1988] argues that women have "computer reticence"," a wanting to stay away because the computer becomes a personal and cultural symbol of what a women is not." Women use technology much less than men as a means of self-expression [Benston 1988], and will even deny that the computer can be a medium of self-expression [Kramarae 1988]. While there is a history of women appropriating technologies to use them in ways unintended by their male inventors, men have, historically, been the designers of technology, and technology reflects their interests [Kramarae 1988]. By encouraging personal appropriation of computer technology, computers can be seen as a gender-appropriate -- in fact a gender-appropriating -- expressive medium. One research objective, therefore, is to design a gender-neutral technology,

so that, as a keepsake object, it can be used equally by boys and girls to express themselves.

[Cassell 1997] argues that storytelling is an ideal playing field to change the gender imbalance in computer technology. She presents the notion of feminist software design in which authority is distributed to the users, giving them control and voice. One approach is storytelling, for through the telling your own stories, you find your voice.

> *...women repeatedly used the metaphor of voice to depict their intellectual and ethical development; and that the development of a sense of voice, mind, and self were intricately interwined.[Finke 1993, p.13]*

The socio-political ramifications of such feminist-designed software are clear. A child's initial introduction to digital technology is through computer and video games. Those who enjoy the games become familiar and comfortable with computers and are more likely to pursue related interests. The games, still designed mostly by men, tend to appeal primarily to male play styles. "Toys are the visible tools of early socialization, preparing children for adult roles [Lipman-Blumen 1984]." This can be seen reflected in the low number of women in computer science and engineering fields [Frenkel 1991]. Women, more than men, emphasize the symbolic value of cherished objects for emotional attachment and interpersonal relationships, rather than practical use [Dittmar 1991]. Rosebud, by allowing enhancement of the emotional value of keepsake objects through the computer, presents possibilities for the computer as a tool for girls, designed with respect to the external social environment as well as the cognitive and affective characteristics of girls.

And, beyond that, we are giving women a place to speak in their own voices.

> *that women's distinctive experience as women occurs within that sphere that has been socially lived as the personal -- private, emotional, interiorized, particular, individual, intimate -- so that, what is to know the politics of women's situation is to know women's personal lives. [MacKinnon, as cited by, Lewis 1993, p.6]*

This "politics of the personal" is significant, for it allows women to "forge a collective voice, construct representations that could authenticate women's experience..."[Longfellow, as cited by Lewis, 1996, p.16] Storytelling is political and transformative.

> *...our 'dangerous memories' are the basis of our collective consciousness of resistance, subversion, and political action. For this reason, our memories are dangerous to the culture within which we experience our violation and subordination. As Paulo Freire (1972) has suggested, memories of violation and exploitation are pedagogically powerful because of the possibilities such memories afford for learning and action for change*

> *(Lewis, 1977). In this context, our rememberings/retellings are dangerous not because they are interesting cameos of people's lives -- providing a voyeuristic access to deeply private life stories -- but precisely because they stand as a critique of the ways our social relations are organized. [Lewis 1996, p.9]*

Once women have found their voices, they need to be heard, and the web provides such an environment.

> *As women share stories of their own lives, a common experience of oppression and of resistance is recognized. This politicizing gives women the courage to persist in resistance, recognizing that their difficulties have not only an individual basis but also a social and political basis as well. Fear of moving beyond accepted definitions of behavior is not definitively allayed, but the experience of self-affirmation and hope that comes from the affirmation and community of sisterhood gives courage and enables creative resistance.[Welch, as cited by, Lewis 1996, p.51]*

CHAPTER 5

System Implementation

This chapter describes the Rosebud system, design and implementation. It is one instantiation of a computationally augmented keepsake.

1. Overview

Simply said, Rosebud links children's stories to their toys. It is a three-way interaction between child, computer, and toy. The toy serves to inspire and encourage the child, as well as serving as a memory object, the access point to the stories. The computer is an encouraging listener, as well as a teacher, pushing the child to write, write more, edit, improve.

The child and the computer communicate via the dialogue box on the screen, the dialogue focusing on developing the child's written storytelling skills. The computer and the stuffed animal are presented as familiar with each other, with the computer recognizing the stuffed animal and having a database of information about it. In return, the computer shares with the stuffed animal the child's stories, so that the animal can respond accordingly. The child-stuffed animal relationship, which is built upon the traditional bond, provides emotional and psychological support. The animal responds to the child's storytelling with lights and motion. While the computer provides a more sophisticated, "adult" encouragement, the stuffed animal encourages the child to write through an affective bond.

The current Rosebud system includes six stuffed animals:

- A platypus
- An elephant with lights in its ears

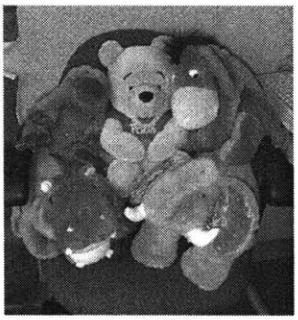

Figure 5-1: Rosebud Animals

- A Hippopotamus
- A small Winnie-the-Pooh bear
- An Eeyore from the Winnie-the-Pooh stories
- A large Winnie-the-Pooh bear, which can move

2. Designing for Multiple Voices

Rosebud is an example of feminist software design, following the principles of feminist pedagogy [Brown 1992] in creating educational software. First and foremost, Rosebud encourages the establishing of voice through an open-ended storytelling framework for the child. It values subjective and experimental knowledge, as well as participatory creativity, supporting writing of personal stories. It promotes collaborative learning, not only among several users and through peer review, but presents the computer as a supportive learner partner, rather than as an authoritative viewpoint, avoiding a hierarchical positioning. Contrary to traditional uses of computers as mathematical machines, Rosebud does not view the child's input as right or wrong, but rather gives only limited structure and guidance. It uses a "language of possibility" rather than a "language of critique [Brown 1992]."

> *[Feminist teachers] were not set up as knowers among a group of nonknowers. There were more like part-time assistants. They helped as much as they could by giving information about their experiences. [Finke 1993, p.17]*

With underprivileged children in mind, the interface design was kept purposefully simple and direct, so that the most novice computer user would have little trouble getting started. The user needs only to know how to read (and even then, minimal reading skills are required) and type (which can be done at any speed). Since the Story Space is free-form typing, children of all writing levels can tell stories. Overall, I aimed for a design which would lend itself to appropriation by the children. I wanted children with different desires and from different contexts to be able to use Rosebud to suit their needs.

Consideration of female-correlated play styles [Benston 1988, Hascombe 1995, Inkpen 1995a, 1995b, Jenkins 1997] was an aspect of the design process, in order to produce a gender-neutral technology. Studies at E-GEMS (Electronic Games for Education in Math and Science) have shown that girls prefer sharing a computer and working collaboratively [Inkpen 1995a, 1995b]. Computers with keyboard and mouse interface are geared towards single-user applications. Rosebud focuses on collaboration by

allowing multiple-toy use and multiple-author storybooks, so that several children can write a story together about all of their stuffed animals. Likewise, since the toy serves as a storage device, children can trade their stories by lending their stuffed animals to a friend.

3. Stuffed Animal Interface

The stuffed animals contain infrared transmitters and receivers, through Poor's iRX board design [46], as well as limited memory capability so that, when held in front of the computer, the computer can identify the toy, as well as download stories to memory within the toy. The animal is used in two ways: 1) as an index to access stories kept on the computer, and 2) as an actual storage device, like a diskette that reflects its contents.

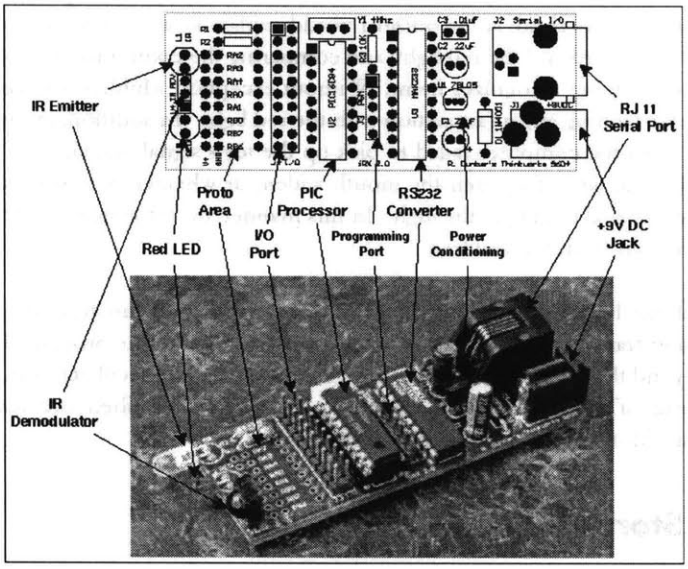

Figure 5-2: iRX Board [1]

1. Figure from Robert Poor's iRX web page: http://ttt.media.mit.edu/people/r

The characteristics of the stuffed animal which are essential to how children naturally interact with it cannot be lost when augmenting the toy, so the toy as a toy must remain essentially unchanged. All wires and hardware are in the center of the toy's stuffing, safe from harm and unable to be felt, and the toy's plushness and squeezability are unaffected. The toy is not tethered to the computer, and can function independently of it.

The only change that can be seen is the faint, blinking red indicator light from the iRX board to show it is powered and properly working. I placed the board and light in locations where 1) if the animal is held up facing the computer, the machine can easily get a clear signal, and 2) the light could make the most metaphorical sense to the child. The result is that for the elephant, hippopotamus, and both Pooh bears, the light shines from within their mouths. Since the platypus and Eeyore don't have mouths like the others, the lights at the "belly-button" location. I decided to have the light visible for two reasons. First, it simplified the debugging process, immediately notifying me if the battery died or a connection was loose. But, equally important, with every child who used Rosebud, at the outset I would explain how the system works, showing them an iRX board and the red light, and comparing the communication to how a grocery store scanning recognizes items. Without exception, children showed immediate basic understanding and a fascination with the red light. In addition, in several circumstances, when the computer failed to pick up the toy's signal, the children would independently clear away fur, open the mouth widen, or whatever was necessary, to make sure a clean signal could get through. In this manner, no information is "black boxed" or kept hidden from the children.

Figure 5-3: Mike "Helping" Elephant Talk to Computer

All six of the Rosebud stuffed animals have this base level functionality: an ability to pick up and transmit signals with the computer, but I am in the process of augmenting some beyond that, with the desire to have more activity and feedback coming from the toy, instead of mostly from the computer. Next are described two features, Story Lights and Motion, which are in progress.

3.1. Story Lights

The elephant stuffed animal reflects how many of the child's stories it knows by way of lights. This has two purposes. First, it provides strong incentive and motivation for storywriting for the children. Secondly, one important characteristic of keepsake objects is that they are able to reflect wear and tear of usage, while not losing their core nature. The Velveteen Rabbit, for example, developed a bald spot where he was always kissed. But with the Rosebud toys, the children's digital interactions with the animals are as important as the physical interactions, however, only the physical is reflected on

the toy. In order for the toys to reflect digital usage, in addition to the physical wear and tear, an LED lights up for each story the child tells. To prevent a technical feel to the toy, the lights chosen are very small LEDs which are placed around the outer edge of the elephant ears, giving the impression of "earrings." This completes the metaphor of the animal as an intermediary with the computer, "talking" to the computer through its mouth (the flashing red LED infrared indicator which can be seen there), and "listening" to the child's stories with its ears, which light up with each story. The LEDs are connected to the iRX board inside the toy. Via infrared, the computer tells the iRX board when a story has been added.

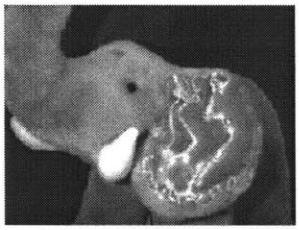

Figure 5-4: Story Lights on Elephant Ear

In the first implementation, the ears were sown with a metallic, shimmery conducting fabric and extraordinarily small lights could be attached directly to the fabric. The fabric's threads running in one direction were able to conduct and therefore served as wires. In this manner, the ears gained a beautiful, delicate look, enhanced by the fabric and lights, and there were no wires or hardware to be felt or seen. However, that design proved too delicate for the rough usage of children and within a few weeks the fabric had been torn. Our current design has larger and sturdier LEDs sticking out of the ears and wires hidden (but they can be felt) between the felt fabric of the front of the ear and the fuzzy fabric forming the back of the ear.

"...his beautiful velveteen fur was getting shabbier and shabbier, and his tail was coming unsewn, and all the pink rubbed off his nose where the boy had kissed him." [Williams 1984, p.10]

3.2. Stuffed Animal Motion

Currently, the stuffed animal is active only at the start and end of the story-writing process. We are now developing a more interactive stuffed animal. In conjunction with Disney Corporation, and following [Umaschi 1997], we are exploring responsive motion of the toy.

The Pooh Bear stuffed animal moves in several ways: clapping paws, moving ears, nodding head, wiggling nose, or any combination of the above. It receives, via radio signals, frequencies which match to particular motions and the degree of motion. These motions are being linked to the current user activity. For example, when the user is typing a story, Pooh will nod, as though it's registering the story. When users play their recording of the story, Pooh's ears will wiggle as he "listens." Motion will also be linked to particular events, such as when the user types "Pooh" in a story, Pooh will clap, as though happy to hear his name. Motion of the stuffed animal will serve several functions. First, the interaction will more consistently uphold the model of a 3-way interaction between a child, their stuffed animal, and the computer. With the current system, once the story begins to be told, the animal has a passive role, and the

only response and feedback is from the computer. The motion will help encourage story writing and editing, but in this case, the encouragement is coming from the toy, rather than the computer. Lastly, the motion will enhance the fantasy that the toy is "coming to life," giving a more clear indication that the animal is truly "listening" to the child's story.

4. On-Screen Component

Rosebud software is written in Semantac C++ for the Macintosh. The on-screen component of Rosebud is comprised of several elements: 1) dialogue space, where the computer talks to the user, 2) story space, where the user types in their stories, and 3) the Storybook, where the stories are archived and can be accessed.

As [Glos 1997b] and [Sakai 1997] have pointed out, Rosebud is well placed for encouraging story writing and revision, and this is what the on-screen component is designed for. Because of the relative novelty of the computer over pencil and paper , as well as the ease and clarity of typing as opposed to painstakingly printing block letters, the computer is an excellent encouraging environment for children's writing. Add to that Rosebud, which provides a traditional children's story-evoking object which communicates and responds to the child. Lastly, motivational features such as the lights on the animal's ears coming on, or the creation of a physical Storybook, urges children to write multiple stories. Once the children are inspired to write, the next challenge is to encourage editing and revision.

Oral enactment of stories is play, but writing of stories is introduced in the classroom environment as a task. [Sakai 1997], working with us on the Rosebud project, developed aspects of the Dialogue Space to encourage children's revision through a social, collaborative activity, rather than the solitary environment often found in the classroom.

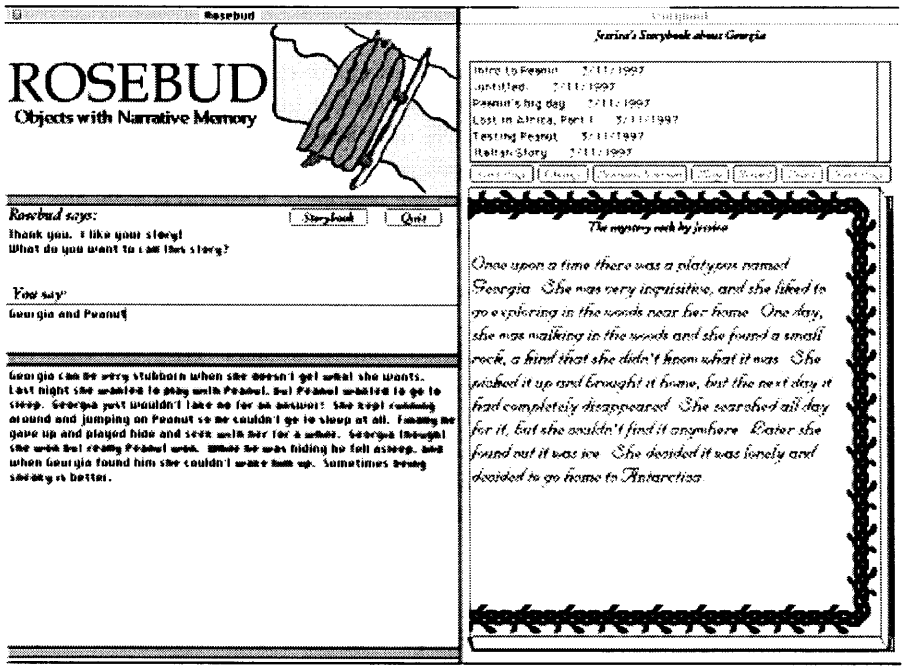

Figure 5-5: Rosebud On-Screen Interface

4.1. Dialogue Space

Moving from oral to written storytelling can be a difficult task, requiring more abstract thought, and it is a solitary activity, lacking external prompting and encouragement [Martlew 1986]. The computer, therefore, guides the user through the story writing and editing process, making it a social interaction with response and feedback, much like Joseph Wiesenbaum's ELIZA from the 1950s which, through minimal feedback, encouraged users to talk about their problems. The computer dialogue is focused on both encouraging story writing, and improving the story. Sakai and I have designed the interaction to make it like a conversation, using colloquial speech and complete sentences, rather than cryptic computer commands. I want Rosebud to have a personality, with likes and dislikes and quirks, but that only comes through weakly at this time. Below I have partially outlined what a child's interaction with Rosebud might be like. Text in bold is Rosebud comments:

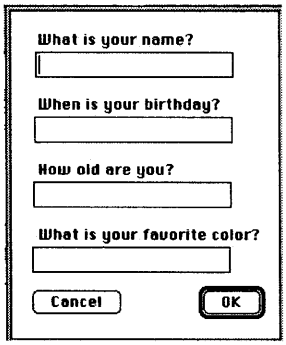

Figure 5-6: New User Information Box

>> Welcome. With whom do I have the pleasure of speaking today?

Rosebud begins by asking the user(s) to identify themselves. If they are new users, they click on the new user box there, and a dialogue box appears, asking for name, birthday, age, and favorite color. If they've used Rosebud before, they can type their name in, or click on it from the "user" pull-down menu. Multiple children can log in at once, encouraging collaboration. From the beginning, Rosebud is gathering information to personalize to an individual and create a feeling of familiarity.

>> Hello, [Jen]. Do you have an animal friend with you today?

Rosebud can be used either with or without stuffed animals. Here, the child types either yes or no. For this example, we're going to assume the child typed yes. This was added so that the software can function independently from the toys, in case the child doesn't have a toy or, if the children can't agree on which animal to use, they may choose this option in order to create their own character. If the user(s) say no, then Rosebud still asks them who they are going to write about, but now they have to create a persona.

>> Please show me who you are playing with today. <or> Who are you going to tell a story about today?

Now Rosebud is requesting to "see" the stuffed animal, at which point the child holds the animal up in front of the computer and it reads the infrared signal. This is the heart of Rosebud: the communication between the traditional, familiar, soft and friendly toy and the "box" of the computer which may seem, depending on the child, unfriendly and unfamiliar. By establishing that the toy and the computer talk and are friends, the already accepted and loved toy can pull the computer into the child's acceptance. [Druin 1987] approached the issue of the non-child-friendly computer interface by placing the computer *inside* of a giant stuffed animal named Noobie, hiding it away. In this case, rather than hiding it, I'm showing children that it can be their friend, just like their stuffed animal is their friend and it's friends with the animal.

If the child has answered "no," to the previous question, then the computer wants to know who the main character of the story is.

>> What is the name of this [type of animal, e.g. hippopotamus]?

After seeing the stuffed animal, Rosebud wants the child to name it. The naming process is key, allowing the child to control [Dyl and Wapner 1996] and personalize [Pap-

ert 1996] their possession. In the case of Pooh and Eeyore, or an animal that the child has used before, Rosebud already knows the names and the question is skipped.

From this moment on, Rosebud refers to the toy by name (as well as the user), and it understands that Jane's platypus is not the same animal as John's platypus, and that they have different names. The computer remembering and using the name the child provides gives the child a sense of power and assurance that their decisions are followed.

>> Isn't this your friend, [X, e.g. Plattie or Peanut]? This is the last story I heard about [x]. <or> Why that's my good friend, [Winnie-the-Pooh/ Eeyore]! An author named A.A. Milne wrote lots of stories about him. Would you like to read one? <or> Oh, this must be a friend I haven't met. Please tell me a story about [x] in the Story Space.

Here is where Rosebud provides other stories as inspiration or fodder for the child's imagination. With Pooh and Eeyore, it's a story by Milne. If the child has written stories about this animal previously, the computer pulls up the most recent, showing the child that it remembers, as well as reminding the child of the last story they told, in case they would like to build on it.

>> Would you like to know more about the [type of animal, e.g. platypus]?

In addition to stories, Rosebud also has other information about the animals. Here the computer offers forth some information about their stuffed animal. This has several effects. First of all, it personalizes the exchange to the particular toy. The computer has a collection of stories and tidbits of information about all the animals, so it can appear a knowledgeable friend. In addition, if the child types 'yes,' they have the opportunity to learn a little something and often that information serves as a starting place for their stories.

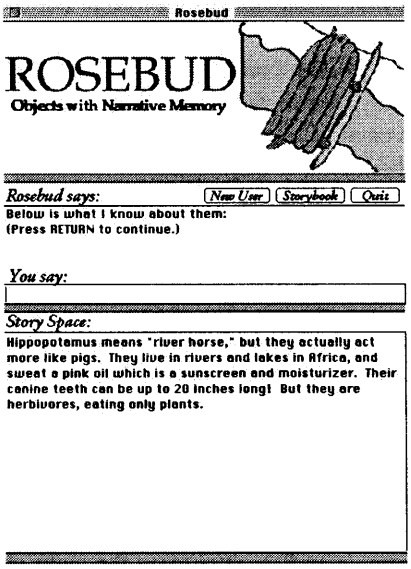

Figure 5-7: Rosebud Gives Animal Facts in Story Space

>> Does [animal x] know [animal y]?

This is another example of personalization and building up a three-way relationship. The computer remembers if user [x] has played with other animals in the past, and it wants to know if the user has introduced them. As mentioned above, it also causes the child to think about the relationships between the individual animals. They have to begin to create a mental model of who the animals are and who they know.

>> Do you have any other animal friends with you today?

The user(s) can play with multiple animals simultaneously. If there is only one user, this encourages the child to explore social dynamics and relationships between the different animals, developing a community of toys. The next question will enhance this effect. In there are several users, this allows each child to include their own animal, encouraging collaboration, and giving every child a voice and a part of the story (the part about their animal) that they control.

>> Please tell me a story about [x] in the Story Space <or> Please tell me another story about [name of animal] in the Story Space.

This is where the dialogue has been leading up to: asking the user to tell a story. Hopefully, by this point, the child is relatively at ease with Rosebud and will willingly type in a story. But in case they are still shy, the computer can react accordingly.

By this point, the child has given the toy a name, said if the toy knows their other toys, possibly learned something about the animal, or read one of Milne's stories. If they have written previous stories, they have seen their most recent. All of this serves as story fodder and helps the child find a starting place. Many of our users have done just that, writing stories about how the animal got its name, how it meet the other animals, incorporating information they learned about the animal (e.g. that platypuses live in burrows), incorporating elements from Milne's story world, such as some of the other characters.

>> Please tell me more! Don't be shy. and/or I like your story. and/or I'd like to hear more.

The system gives generic encouraging feedback such as "I like that story." It looks at the length of the story and, if short, says, "Don't be shy! Please tell me more." This is based off of ELIZA's encouragement.

>> Thank you. I like your story! What do you want to call this story?

This is another chance for personalization and control. The practical value is that the title is used to index the stories in the Storybook.

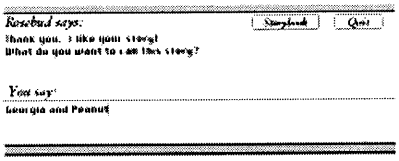

Figure 5-8: User Names Story in Dialogue Space

>> Would you like to read your story for me?

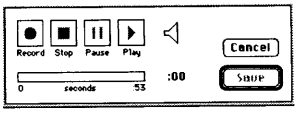

Figure 5-9: Audio Dialogue Box

The most repeated request of children in early testing was to hear their stories told back to them by their stuffed animals. Therefore, upon finishing a story, children are asked if they are willing to tell the story aloud to the computer. If they agree, a dialog box appears with record, stop, play commands. They are able to record, listen to their recording, and re-record, until they are satisfied. In the storybook, the play and record options are repeated. This addition follows through on the link between oral history

and keepsake objects, and will play upon children's love of repetition and hearing their own voice. Most importantly, it places the child in both the role of the author and the listener.

>> Read your story over again. Do you want to make any changes to it?

When the children read their story aloud, they see and hear errors that would otherwise have gone unnoticed, or from having spoken, they know better what they want to say. This is therefore one entry point into the editing dialogue, where the computer asks a variety of editing questions and the user has the option to go back and make changes.

The computer's function is to guide the child, unfamiliar with revision, to teach them how to read their own work carefully. [Sakai 1997] implemented three editing prompts. First, general questions are asked, geared to focus the child to examine particular sections of the story, such as asking about the ending of the story:

>> Are you happy with the way the story ends?

Second, the system runs a function to check the beginning of the story (first eight lines) for words and phrases indicating context, such as "today" or "in the." If it fails to find any, it asks for contextualizing information:

>> I was wondering... When did this take place? Could you add into the story more about when it occurred?

>> Could you tell me where this happens? You might consider adding something to the story about where it took place.

And last, it encourages peer revision by recommending the user ask another to read and comment on the story.

>> If you can find someone else, you might consider reading the story to them. You might think of something else you want to add to your story.

Wording of this interaction is guided by feminist pedagogical principles, avoiding a right/wrong philosophy and authoritative wording, but instead making suggestions or professing its own confusion and asking the user to clarify. Rather than the editing being based off absolute criteria (e.g. correct spelling and grammar), it is based of the child's liking and satisfaction with their story.

This revision sequence is activated in several scenarios. First, revision prompts are activated after the users read their story aloud, which places them in the role of the listener, and can bring to attention story errors previously unnoticed. Second, it is also beneficial to review a story with "new eyes" after some time has passed. Therefore, delayed revision is encouraged by the system.

4.2. Story Space

The story space is a free-form text input box, empty with a scroll bar to accommodate all length stories. Unlike many "story writing" commercial products available, we have not provided any structure or content, such as "story starters," pre-made characters, or scenarios, for the child's storytelling. Rather, the objective is to give the child complete authoring power. This can be intimidating at first, which is countered with the Rosebud personality and the stuffed animal. The story space was made purposefully large, taking up a great deal of the screen. This emphasizes its importance and provokes a desire to put something into it.

4.3. Storybook

The stories are archived in the Storybook. The stories are indexed by author(s), toy(s), and time. For example, if Marcy and Roberta are telling a story about Peanut and Plattie, then the "Storybook by Marcy and Roberta about Peanut and Plattie" will appear. Those stories also show up in the individual books of Marcy and Roberta, marked as co-authored.

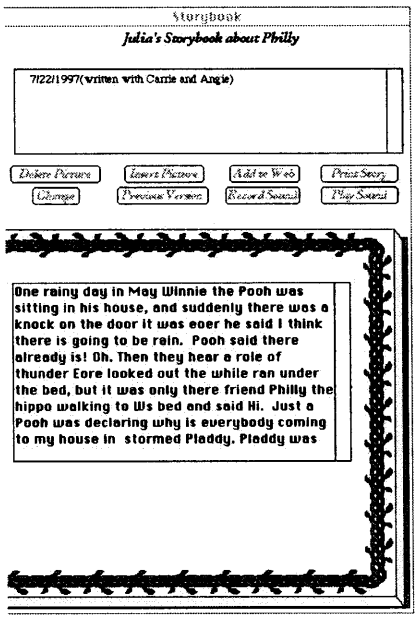

Figure 5-10: Rosebud Storybook

From the Storybook, the children can do a variety of activities with their stories. 1) add stories to the web, 2) print them out, 3) add a picture, 4) record or play an audio segment to go with it. Also, for editing and revision purposes, whenever users change their story through the "change story" button, the older version of the story is automatically saved. Older versions can be flipped through by clicking on the "previous version" button, allowing the child to see their progress or show changes to another.

Adding to the web and adding pictures provides the next step in complexity with Rosebud. [Papert 1996] discusses the importance of extendibility of a project so that the learning potential is never-ending. As loosely-constructed storybook options, each using different software and each with a tangible result, and all adding to the final result, I provide focus for learning new software, as well as motivation for doing a longer-term project.

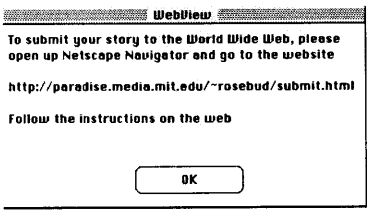

Figure 5-11: World Wide Web Dialogue Box

When the user clicks on the web option, a pop-up menu appears (include image here) which gives the child directions for putting their story on the web page. This requires launching a web browser, such as Netscape, going to the correct address, and cutting and pasting the story there. It's a relatively simple process, but introduces the child to the key knowledge to begin web browsing: the web browser and web addresses. They then can see their own story "published" as well as look at others' stories.

When the user clicks on the picture option, a pop-up menu appear giving directions for adding a photo or picture that they have already created. This function was designed with teacher or mentor aid in mind, who can show the child 1) drawing tools, such as Kid Pix or Photoshop, to helping them create a drawing, 2) the Macintosh digital eye, so they can take photos of themselves and their animals, and 3) how to capture images from the web and save them. Rosebud merely allows the chosen image to be added to their Storybook.

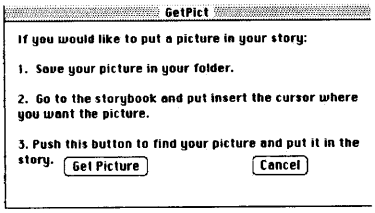

Figure 5-12: Dialogue Box for Adding Images

In section 6.4, I talked about the importance of giving the voiceless a voice, and giving them a place to be heard. Rosebud is designed to give children of all types a voice -- to encourage them and convince them that they have something of worth to say. But where are they heard? Who is their audience? First, they are their own audience when they listen to their own voices. Then, they are encouraged to use peer review and show their Storybook to their friends, who becoming their second audience. Next,

they can print our their stories, showing them to parents and teachers and those who don't have computers. Lastly, they can put their stories on the web, where their audience is the world.

CHAPTER 6

Results

When designing children's software, it is necessary to work with children [Druin and Solomon 1996] to watch their interactions and understand how the system works or doesn't work for them. With this in mind, throughout the design process we had children informally trying out Rosebud and giving us their feedback. This summer, we performed more extensive user studies at two afterschool programs. This chapter presents my results with the Rosebud system, both user-studies results of Rosebud as an interactive storytelling system, as well as analysis of Rosebud as a keepsake.

1. Early feedback

During the half-year of development, approximately fifteen children, ranging in age from seven to twelve years, used Rosebud prototypes, giving early feedback on the nature of the three-way interaction between the child, toy, and computer, and the success of the computer prompting.

Overall, responses were favorable, indicating a good basic concept. Prompting showed success in encouraging storytelling from initially reticent children; however, some confusion indicated a need to separate user story writing from user dialogue with the computer. That interface change was implemented. Children responded with great enthusiasm at the "relationship" between the toy and computer, marveling that the computer knows and remembers their stuffed animal friends, as well as their stories about the animals. They expressed desire for the animal to read their stories back to them. We therefore added the audio recording capability.

2. Overview: Extensive User Studies

Below I describe the results from each of these situations. For my analysis, I've chosen to use a narrative strategy. As [Polkinghorne 1995] describes, narrative inquiry is a subset of qualitative research in which "stories are used to describe human action." Such a narrative approach divides into two categories, based off Bruner's two types of cognition: paradigmatic and narrative. In the paradigmatic approach, taxonomies and categories are created out of the common elements of the database of stories collected. In the narrative approach, events are gathered into explanatory stories. I will be using the narrative-type approach.

I've chosen this still somewhat unconventional approach for two reasons. First, my research concerns attention to voice, and the traditional quantitative approach tends to silence voices. Historically, researchers with little to no hands-on experience in the classroom, made the decisions concerning classroom studies and implementation of results, rarely interacting with the teachers who would be putting the results into practice. In addition, "teachers' voices were silenced in the accumulation of knowledge about teaching, in the formulating of policies that controlled how teaching was done and how teachers were educated, and in the distribution of rewards, in terms of both money and prestige, that accrue to knowledge producers."[Carter 1997, p.29]

This is changing, however, with "increasing attention to 'voice' as a central theme and a rejection of "grand theory," that is, broad generic formulations of rules or principles, in favor of particular stories of lived experiences as women, mothers, and teachers." [Carter 1997] Methods of inquiry are focusing on stories and the particulars of a situation. While educational research tends to be about universals, practice is "concrete, immediate, particular, and local." [Carter 1997]

My second reason for using narrative strategy is that, as I worked with the children and found myself in the teacher role during the past six months, I began to strongly feel that what I was learning could not be explained through numbers or patterns, but that rather it was my "situated and personalized understandings" that needed to be conveyed. [Carter 1997] explains, "...story was a way of grasping the richness and indeterminacy of our experiences."

3. Pilot User Studies

3.1. Environment

I will begin with a description of the environment, because the Rosebud workshop was designed to fit into the Clubhouse philosophy.

The Clubhouse's objective, as the web page (http://www.tcm.org/resources/clubhouse/thecc.html) states, is to be "an after-school learning environment where young people explore their own interests and become confident learners through the use of technology." It is guided by four principles: 1) constructionist activities, 2) community environment, 3) offering resources and opportunities to those otherwise without access, and 4) encouraging projects related to students own interests.

Girls' Day is every Monday from 2 to 5:30pm. Only girls are allowed, and all the mentors are female. Because of my own personal interest in attracting girls to technology, as well as my objective to make my technology appeal to girls, I chose to mentor during Girls' Day, and to bring Rosebud in on Girls' Days.

The environment is casual and free. There is no attendance policy, so every week is a different group of kids, with some one-timers, some regulars, some who pop in now and then. The girls are allowed to come and go as they wish, so from 2pm on people are arriving and leaving. There's a McDonald's on the other side of the Museum and it is an honored ritual of many of the girls to bring money and go there each Monday. Since they are allowed to go by themselves, it is partly a ritual of independence.

There are no assignments or regulations, but mentors are there to help and encourage the girls with projects. Without any structure, sometimes girls spend their time there walking around, talking to people, going to McDonald's. Others might settle down in front of one computer and spend hours web surfing for song lyrics or playing with the Macintosh digital eye. Sometimes girls will focus in on a project with an end objective, but this is more rare.

I have mentored on Girls' Day for six months and brought Rosebud to the Clubhouse during one month of the summer (four consecutive Mondays). This is not a sufficient length of time for a truly powerful case study, but provided a starting place for understanding Rosebud and where it fits into computer education, as well as allowing me to discover and fix any implementation errors before the longer study at the youth center.

3.2. Rosebud Workshop

Because of the informal environment, rather than depending on having the same children each week, I structured the workshop so that I would try to work with each person for a little over an hour in one day. First, I would talk to them and ask a few basic interview questions for about five to ten minutes. Then they would use two pieces of software, Rosebud and Broderbund's *The Amazing Writing Machine* for about a half hour each, then I would ask some feedback questions for about ten minutes afterwards.

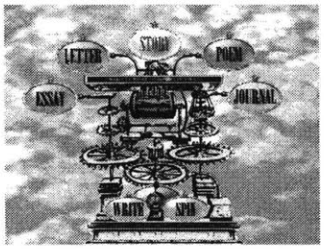

Figure 6-1: *The Amazing Writing Machine*'s Initial Page

The Amazing Writing Machine is commercial software for story writing. The initial screen allows the user to choose between four types of writing: story, poem, journal, or X. Then the user chooses between *story-write* or *story-spin.*

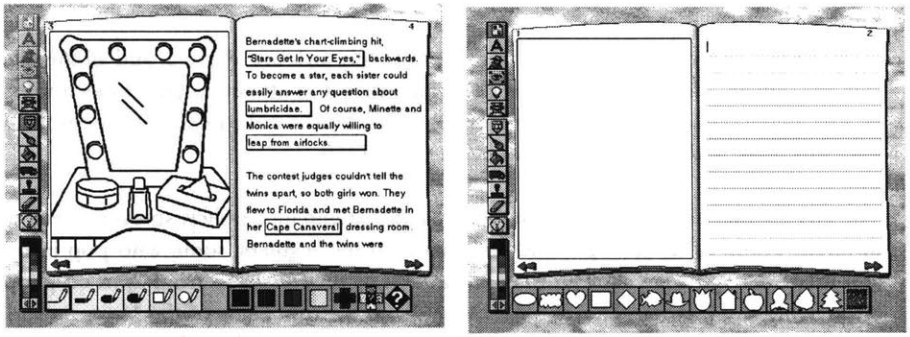

Figure 6-2: *Story-Spin* and *Story-Write* in *The Amazing Writing Machine*

Story-Spin (on the left) is a mostly pre-written story, that the user can choose some words for (the words in boxes). By clicking on the box, they get several choices, or the ability to enter in a word of their own. Story-spin comes with picture outlines that can be colored-in. Story-Write, on the other hand, is a blank book, and the user has to author the story and draw the pictures from scratch.

I was able to do this with four girls from the Clubhouse, ranging in ages from nine to thirteen. The girls were from a mix of backgrounds, with one from Harbor Point and the others from Boston. I will discuss the overall results, and, in more detail, my interactions with two of the girls: Kay and Linda[1].

1. For anonymity, all subject names have been changed.

3.3. Interpretations

To begin with, kids avoided the increased structure of the Rosebud set-up: the need for a parental permission form, the video-camera, having to talk with me before and after. When I talked to the children and asked them if they wanted to sign up for Rosebud, I got a strong feeling of shyness -- many told me that they weren't "any good at writing stories." The set-up appeared to be intimidating to many.

On the other hand, the two children who I knew well from the previous spring, Kay and Linda, weren't shy at all. Kay immediately jumped into telling stories. It seemed as thought all she needed was the excuse and she began telling several long stories. Linda brought in some of her own stuffed animals, in particular, an old, much loved Kanga from Winnie-the-Pooh. Interestingly, when they used *The Amazing Writing Machine*, Kay reported preferring the Story-Spin, while Linda preferred Story-Write, the opposite of what I might have expected. Kay liked the amusing choices and that Story-Spin required less effort. Linda preferred the greater control that Story-Write provided.

The power of *The Amazing Writing Machine* is partly the slick multimedia element, which all the kids loved, but also the flexibility for different types of story writers. It is produced by the makers of KidPix, and the drawing aspect is the same format as Kid-Pix. The ability to easily add their own drawings was one of the most repeated favorite features.

4. Youth Center User Studies

4.1. Environment

Harbor Point is an after-school program during the academic year, and a summer camp during the summer, provided primarily for children of those in Harbor Point housing. The children tend to be underpriviledged, ages 6-17.

4.2. Rosebud Workshop

Working in conjunction with the Harbor Point summer camp coordinators, the "Rose-bud Computer Workshop" was added as one of the activities kids could sign up for,

alongside sailing, basketball, and other various activities. The Rosebud workshop ran for one week from about 12:30 (after lunch ends) until 3:30pm (snack time), then sometimes for another hour, till camp close (4:30pm). Children signed up ahead of time, and were given parental permission forms to be signed[1].

The original plan was as follows: In pairs, each kid would try Rosebud in three scenarios: with no stuffed animals, with one stuffed animal, and with two stuffed animals. There would be an approximately one-hour pre-Rosebud interview and one-hour post-Rosebud interview, to talk to the kids, getting to know them better, putting them at ease, and finding out what they think. This would allow us to compare and contrast across pairs (in our limited sample size) to look for patterns of usage to try to better understand the role the toy plays and its affect on collaboration.

Because of the structure of the youth center, rather than having six children continuously, we had a changing flow of four children, making the above plan difficult to implement. So rather than the organized, controlled user study planned, we worked with the children we had, allowing them use Rosebud in a variety of ways, some of which they proposed. Quite accidently, rather than an authoritative study where we decided how the children would learn and use Rosebud, it became collaborative, with us working side-by-side with the kids.

The scenarios that Rosebud was used in:

Monday:

- Chris and Samantha: no stuffed animals
- Sarah and Lucy: one stuffed animal

Tuesday:

- Sarah, alone: one stuffed animal
- Chris, alone: one stuffed animal
- Chris and Sarah: two stuffed animals

Wednesday:

- Chris and Sarah: one stuffed animal
- Jake, alone: one stuffed animal

1. Same as the permission forms given to the Clubhouse participants.

- Chris, Sarah, and Jake: no stuffed animals

4.3. Their Stories

Some stories were surprisingly personal and intimate, such as the following two, both about mothers: the first about losing one's mother, the second about mother's love. Given a chance, these children obviously have thoughts to work out and things to say. The first story is painful for its lack of a sufficient answer to a parent's death. On the other hand, it describes a strong and enduring bond with a friend, Pooh, who is there for Eeyore when his mother dies, even if he doesn't have any answers. The second story is a composite portrait of a mother, told by two children, a boy and a girl. Both stories are startling in their directness and honesty of emotion and thought.

> *"Once upon a time a very long time ago there were two friends named pooh bear and eeyore. They liked each other very much and let nothing get in the way. One day eeyore felt sad because his mother passed away. So he went to his good friend pooh bear to ask for advice. Eeyore asked pooh bear and pooh bear said to take it easy and relax. Eeyore said ok I will." --Written by Sarah.*
>
> *"My mother is nice and she love,s me.And my mom help me with my home work . She take me to the Arcade to play game and have fun on my birthday. And we go to the cook -out at my grandma's house and we have fun. That show she love me. And I care about her.And she care about me." --Written by Chris and Samantha.*

By the end of the week, the children were more relaxed and casual, and seemed to take liberties they would not have taken on Monday. This was reflected in their final story as well, which was much more outrageous and fantastic, breaking from the bonds of stories dictated from the adult order, no doubt aided as well by the fact that three of them wrote it together:

> *"ONE day Lisa Michael was go Wal mart to eat friend crab &pu pu platter When she got there she saw her dinosaur friend Reptar. After they ate there fried crab & pu pu platter Reptar bowed down and said will you married me. Lisa said o.k.that day they got married at Wal mart the end" --Written by Chris, Jake, and Sarah*

4.4. Interpretations

One of the biggest contrasts was between single-user and multiple-user use of Rosebud. Several children, in post-process interviews, professed a preference with working

alone, because of the increased control. On the other hand, when two or more worked together, there seemed increased creativity and they remained more focused on the task, the social aspect holding their attention span longer. In general, it was difficult for the children to sit still for long periods of time. They were constantly getting up, sitting down, spinning the chair, and so forth. When working in pairs or as a group, this excess energy was more likely to be expended interacting with the other children working on the same task. There were wide variations between children's behavior when working alone. While Chris and Jake were very focused and persistent, typing away without speaking, Sarah had a great need for social interaction, and rarely a minute passed without her reading her sentence ideas aloud, making comments, or asking questions about spelling or the animals. At one point, Chris exclaimed in frustration, "She keeps on talking!" When they worked together, the two work styles balanced out, with Sarah constantly verbalizing to Chris and Chris stabilizing Sarah.

There was a great deal of manipulation of the stuffed animals, sometimes seemingly unconscious, sometimes conscious. Sarah would take time out of writing to hug one of them, and would often write with one under her arm. Interestingly, the children never played with the stuffed toys not in the current story.

In addition, all the children wanted to know more about the animals. Sarah, in particular, asked non-stop questions:

- "Do hippos and platypuses live close together in real life?"
- "Can platypuses go in the water?"
- "Can they (platypuses) go out of the water?"
- "Where do hippos sleep?"

Afterwards she told us, "I didn't know that they [platypuses] lives in the water. Because they look so furry. And hippos [which she knew lived in the water] are not that furry."

The set-up, with new computers and the video equipment, completely changed the environment and affected the children's behavior. They all had great fascination for the video camera and loved to talk and act in front of it, as well as watch through it.

Rosebud's personalization struck them as magical. Chris, when the Storybook came up on the screen, exclaimed, "It's got my name on it!" Sarah loved how the computer would "read" what animal was being used. She would run through the program to that point, and then restart it in order to hold up more animals. She would cycle through this over and over again. Jake's eyes got wide and he said, "Oh!"

When asked which stuffed animal was her favorite, Sarah insisted "all of them... because they can hear me, and if I say one, they are all going to get mad!" And, later, when she was asked what was her favorite and least favorite of telling stories using no animals, one, or two, she replied for her favorite, "Two ... because one gets to meet the other one," and she replied no animals for her least favorite, "because you didn't get to show it to the camera."

4.4.1. Distribution of Authority & Finding Voice

Control. Several children expressed preference for working alone, because it gives them entire creative freedom. This mirrors some children's preference for *The Amazing Writing Machine's* Story-Write option at the Clubhouse, because there one can write anything they want. Often control is linked to possession of the keyboard, and interestingly, Sarah said during her post-process interview that she enjoyed Rosebud because she got to use the keyboard. In another situation, Samantha took the keyboard by force, linking knowledge to control: "I know what I'm doing, ok? I've written with computers before!" In contrast to a single keyboard, with multiple stuffed animals, there was the option to share, illustrated when Sarah said to Chris, referring to the animals, "You use one of yours, I'll use one of mine."

Appropriation. The children expressed a fascination with the computer microphone, often holding it and talking or making sounds to it, even though it wasn't recording. Without doubt, the recording and playback of their stories was one of the children's most enjoyed activities, with Chris and Samantha missing snack time in order to make their recording perfect. Often Chris and Sarah would make rap sounds into it, so at one point, I asked them why they didn't rap their story. They immediately became excited at this prospect, and began to carefully design the structure of their story, such as reading it aloud to check for correct line length, so that it would sound good. They recorded it several times, with lots of laughing, but determined to make it sound good. Afterwards, they did the "hairstyles" of Eeyore (making his mane stand straight up) and Hippo (I'm not sure what they changed there) and did a "dance" with the stuffed animals to the rap story. They then watched the dance on the video-camera. The audio also had a powerful side-effect of encouraging story editing. Chris had great difficulty typing his stories, somehow forgetting words, such as typing "bunch grass" for "bunch of grass." When he tried to read his story aloud, he became distraught, realizing that what he typed was incorrect. When the computer asked him, "Do you want to make any changes to your story?" he replied "yes" and edited his story. In this way, he voluntarily chose to edit, although that's a task that's hard to encourage.

The system was designed to be appropriated by the user, but what I saw at Harbor Point was that the children needed some encouragement to appropriate the system to suit their own interests, culture, and background. Chris, early in the week, asked me, "Can I write a poem?" "Yes," I replied. "Really?!" he exclaimed back. He seemed doubtful that he could do what he wanted.

During the post-process interview, Chris summed up the two issues of power and appropriate when told me that his favorites of the stories he wrote during the week were the last one cause "the lady married the dinosaur in Wal Mart," expressing pleasure at allowing such an outrageous event to occur, and his first one, cause it was his alone.

4.5. Conclusions

The children picked up, while using Rosebud, skills and various pieces of information. Their proficiency with the computer increased, learning how to drag-and-drop, use the arrow keys, and open programs. Without us showing them, they played with the iRX boards, and on the last day, because we were busy, plugged in the toys and boards on their own. Their comfort level with these technologies increased, if only slightly.

But more significant in my mind was the effect Rosebud had on their storytelling. Whether or not they said they liked to tell stories, afterwards they called Rosebud "playing" or "a game" and Jake said, "I learned that making stories is fun." We successfully moved story writing from the realm of work into the domain of play, even the laborious and despised process of editing.

The children had a great sense of accomplishment afterwards. Chris proudly listed off all the stories he wrote during the past week, with which animals and if there were any co-authors. Although the stories may not seem like much -- they are short and are clearly the works of children, the amount of effort the children invested was high, with every word debated. Take, for example, the following story:

> *This morning when pooh bear woke up he saw his good friend Kermit. He took his bath and got dress and went to play with his friend Kermit. They played iot of games like: basket ball, jump rope, foot ball, volley ball. After they played the games they had dinner and watched movies took a bath and went to bed .*

Picking the activity "volleyball" took over five minutes of discussion among the children. Sarah insisted that it be an activity for girls and had to be two words (for the

rhythm), "What's a girls' game that has two words?" Plus she wanted it to be "JUST for girls," not an activity for boys as well. She was dismayed at their inability to think of one, and had to settle for volleyball.

These children reported having little to no experience with story writing, and writing these stories were a very big deal. Winnie-the-Pooh went from being a cartoon passively watched on television, to a character they created stories about. They found a desire: to write good stories, or sing good story songs, and this inspired self-motivated learning and effort, whether it was asking about platypuses or editing a story.

It appears that ease-of-use drew in the initially hesitant children. By "talking" to the computer and typing a story, they immediately accomplished something: a storybook of their own, with their name on it, and they were already practicing their creative writing skills. I have followed the advice of [Dewey 1938], [Papert 1996], and feminist pedagogy [Finke 1993] in my approach, allowing the users to be self-directed and experiential, allowing them to learn indirectly through a personal, purposeful project. This constructivist approach follows Papert's guiding principles to creating a project: the project is infinitely expandable, and it appeals to the children, connecting with what they already enjoy doing (e.g. singing rap songs), yet enriching that activity and taking it further: "The planning must be flexible enough to permit free play for individuality of experience and yet firm enough to give direction towards continuous development of power."

I have focused the children on a week long project which encouraged writing, creative storytelling, collaboration, and showed them something new and unusual: a stuffed animal interfacing with the computer. Most importantly, I think they began to understand what is perhaps most important about computers: "you can use them for your own purposes." [Papert 1996, p.27].

5. Analysis of Keepsake Value

One of the core paradoxes Rosebud confronts is the concept of a manufactured keepsake object. I began this thesis with a personal description of organic keepsake objects: items which, through intense, personal experiences, became keepsake in nature. The necklace, the watch: these were not designed to purposefully become keepsakes. They contrast with the mass manufactured souvenirs to be found in stalls on the street corner of any tourist destination: hundreds of small, plastic Eiffel Towers, to remind one of their vacation.

Rosebud is manufactured, with chips and electronics placed inside to enhance the keepsake nature. But, unlike the Eiffel Towers, an unused Rosebud has no meaning before someone adds their stories. It is not meant to generically represent a class of experiences, such as "my vacation in Paris," but is more of an empty book, placed inside a highly organic object likely to become personally valuable to an individual. Like a camera, it is the tool for creating keepsakes. A camera is meaningless until someone takes a photograph, and that photograph is *theirs*, not manufactured or mass marketed.

In[Williams 1984, p.6]'s *The Velveteen Rabbit*, the rabbit asks the skin horse what is it to become real:

> *"What is real?" asked the Rabbit one day..."Does it mean having things that buzz inside you and a stick-out handle?"*
>
> *"Real isn't how you are made," said the Skin Horse. "It's a thing that happens to you. When a child loves you for a long, long time, not just to play with, but REALLY loves you, then you become Real."*

Likewise with keepsakes: it is not gears that click and turn -- is it not the technology -- which is important. It is if children love the Rosebud animals, and take them into their hearts. The technology may increase the likelihood of this. In this respect, I do not know yet if Rosebud is a success. Only time will tell us. Our work is just begun.

These children have given life to Rosebud by giving it their stories.

CHAPTER 7

Conclusions

In this thesis I present the concept of digitally augmented keepsake objects as a merging of the physical and digital worlds to support self-identity. I outline how the physical world, traditionally, has served to aid in self reflection, and how we might take advantage of the elements of the material world which allows this, and build upon them computationally. I then narrow my focus to one instantiation of such a system, Rosebud, which uses stuffed animals, binding children's stories to them.

Rosebud is but one example of what can be done by enhancing actualities, and in particular, actualities which have significant meaning to someone. Rosebud has features not common to all keepsake objects, and therefore, not applicable to all keepsakes, yet of value and significance for designing that system. In this case, it is a child's toy, with story-evoking potential, and is gender-neutral. Therefore, I explore the context of designing a storytelling system for children of both genders. Its features which are common to all keepsakes: tangibility, place-holder for stories and memories, personal -- these elements are augmented and can give us information on augmenting keepsake objects in general.

Rosebud illustrates how the marriage of keepsake objects, valued for their strong emotional power and evocative nature, with the computer, can allow the computer to better satisfy users' social and cognitive needs. Rosebud provides a place for the interaction of story, memory, and self. It aims to aid in the development of children's storytelling skills, gives greater power to an object as a memory device, and allows for development of one's voice and, therefore, one's self. Its functionality changes over time as a user grows from a child, learning how to write stories, to an adult, wanting the stuffed animal to be a memory object of childhood. This work demonstrates one application of tangible media, where the physical component, a stuffed animal, appeals to girls and is a story-evoking object, while the digital component provides memory and a framework to encourage children to explore storytelling further.

Tangible media, or computationally enhanced environments are the future. While there is research on the formation of identities in the digital world [Donath], and work on the formation of identity in the physical world [Csikzentmihalyi 1981], how will these meet in a computationally enhanced environment? This thesis explores how tangible media will need to look at the affective nature of objects, as well as their functional value. With digital media, unanchored and fluid, meeting the Protean self, there is a need for computationally enhanced keepsake objects as a place of interaction of memory, story, and self: where an individual's history can be stored and serve to stabilize self-identity.

CHAPTER 8

Future Work

This thesis is only a beginning. With one example, it begins to map out the territory of computationally-augmented keepsake objects.

1. Rosebud

The prototyped system, Rosebud, can be further developed along many lines, and here I mention what I think are the most important aspects of the system which should be completed.

1.1. Rosebud Computer Personality

Making the written storytelling process a social experience with the computer is key to keeping children's interest and enjoyment, and much can still be done to expand the computer dialogue capabilities, allowing for a more developed and natural long-term interaction. First, there should be further development of the "agent" model of the computer personality, and its model of the user. It's vocabulary of comments and questions should be large enough that every interaction is different. It should be constantly adding to its database of information about the user and use that information in its dialogue. Rosebud should also be made multimedia, with audio to go with the text on the screen and an animated character on the screen. One additional intriguing possibility is for the Rosebud character to change depending on what toys are used. For example, the character could wear a safari hat and have the African savanna in the background when the elephant or hippo is used.

1.2. Rosebud Necklace

One difficulty with Rosebud is that most children already have a much cherished, favorite stuffed animal, one often that they've had for years. It doesn't make sense to give them a new, strange one. Using Winnie-the-Pooh and Eeyore countered this to some degree, since the children consider the characters old friend, if not the actual toy, but what is really needed is a way to make children's own stuffed animals Rosebud animals. What I propose is to slightly redesign the iRX board, which is what is inside the animals, and place it like a locket onto a necklace. That way, children can snap the necklace around their favorite toy.

1.3. Archiving Capabilities

The difficulty with using digital technology for archiving purposes, such as in the case of storing information with a keepsake object, is that with technology rapidly changing, and inconsistent backward compatibility, it's likely that in twenty years, the hardware and software will be too out of date to access the data. A comparable situation is trying to retrieve your autobiography which was stored on punch cards.

The solution is to make the system self-sufficient and highly stable. In the case of Rosebud, the toy should function effectively independent of the computer, particularly playback. This can partially be done with audio storage in the toy itself, so that with only the toy, the stories can still be accessed, but not in print form.

1.4. Other Applications

In this paper, I have explored only one use of Rosebud: children's storytelling. However, Rosebud is highly applicable for abused children therapy, as well as for comfort [Francis 1988] and reminiscence therapy for the elderly [28].

Rosebud combines two elements which have been shown to benefit the elderly: stuffed animals and personal storytelling. [Francis and Munjas 1988] showed that the introduction of stuffed animals into a nursing home improved the well-being of the residents and decreased depression. Add to that reminiscence therapy: encouraging the retelling of one's own life story has multiple benefits. Due to the loss of spouses and friends, there is a need for life story confirmation which reminiscing can provide [Viney]. It can empower the story-teller, reducing feelings of powerlessness, particular important for those suffering from a progressive, deteriorating condition [Woods and McKiernan]. It reaffirms a personal sense of identity, which can be lost in an imper-

sonal institution. And the sharing of personal histories can strengthen and improve relationships between residents and staff [Woods and McKiernan].

Rosebud is easily adaptable to encourage reminiscence in particular. One question to be addressed, however, is whether the above benefits would remain if the reminiscence is through the Rosebud system.

2. Other Systems

Rosebud is only the first instantiation of a digitally-augmented keepsake object, and more systems need to be built to explore this field. We are in the early prototyping stages of computationally-enhanced keepsake objects for a community of individuals. The challenge faced is to represent the community while simultaneously maintaining individual voices.

While in academic, projects such as Rosebud, Noobie [Druin 1986], and SAGE [Umaschi 1997] are exploring how stuffed animals and computers augment one another, the toy industry is also merging new technologies with traditional toys, with Microsoft and Mattel both releasing interesting products this fall.

Designed for children two to five, Microsoft is releasing the first of its "ActiMates" characters this fall: a Barney stuffed animal which can function alone or, with appropriate hardware, can communicate with a TV/VCR or home computer via radio signals. Alone, it moves, talks, sings, and responds to touch or changes in lighting. With the videotape, it becomes a "viewing companion," commenting on the show. With a PC, it reacts to several companion CD-ROMs. [Microsoft News Release]

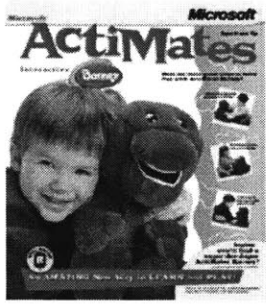

Figure 8-1: Microsoft's Forthcoming ActiMates

Simultaneously, Mattel is releasing *Talk with Me Barbie*, a Barbie doll which can communicate with a child's own mini-computer via an infrared signal in her necklace. It personalizes to the child with name, birthday, favorite color, and when Barbie talks, her lips move. The child's computer can plug into a regular PC which has a CD-ROM to accompany it.

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Appendix

Interview Questions

Interview questions-Computer Clubhouse and Harbor Point

Basics:

1. Name:
2. Gender:
3. Location: Clubhouse or Harbor Point
4. How old are you?
5. What grade are you in at school?
6. Do you have any brothers or sisters? How many? How old?

Computer experience:

1. Do you have a computer at home?
2. If yes, what do you use it for?
3. Name some games/applications that you use. What's your favorite game?
4. Do you use a computer at school and/or Harbor Point?
5. Is yes, what for? When?
6. Where do you use a computer most?
7. About how much do you use a computer? How many hours a week?
8. Do your siblings/friends play on the computer?

Attitude towards computers:

1. Do you like computers? Why or why not?
2. What do you like best/least about the computer?
3. What do you like to do best on the computer? Why?
4. What do you like to do least on the computer? Why?
5. Do you use the computer alone or with others?
6. If with others, then who? Why?
7. If you could do anything on the computer, what would you want to be able to do?

Stuffed animals:

1. Do you have any stuffed animals at home?
2. How many?
3. Do you play with them much?
4. If not, did you? When did you stop?
5. Where do you keep them?
6. What types of things do you do with them?
7. Do you have a favorite? If so, what type of animal is it? What's its name?
8. Do you play alone and/or with others? Who?
9. Do you play with several stuffed animals at once, or just one at a time?
10. If your stuffed animal could do anything, what would you want it to do?
11. What's your ideal stuffed animal?

Storytelling:

1. Do you like to tell stories?
2. Do you like to write stories?
3. Do you write on your own? Why or why not? What sort of stuff do you write?
4. At school, do you write much? What sort of stuff do you write? Do you like writing at school?
5. Do you like to read?
6. Do you like to hear stories?

Motivation (Harbor Point):

1. Why did you sign up for this workshop?
2. What do you hope to do today?

Software Comparison: *The Amazing Writing Machine* (Computer Clubhouse):

1. What did you like best about the AWM?
2. What did you like least about the AWM?
3. Which did you like better: *Story-Write* (when you were given a blank storybook) or *Story-Spin* (when you were given an already written story to change)?
4. What did you like about each?
5. What did you dislike about each?
6. What was most fun?
7. What was least fun?
8. What did you like better about the AWM over Rosebud?
9. What did you like better about Rosebud over the AWM?
10. What would be your ideal software for writing stories?

Rosebud:

1. What did you like best about Rosebud?
2. What did you like least about Rosebud?
3. What was most fun?
4. What was least fun?
5. Which is more fun: (favorite game) or Rosebud? Why?
6. When would you choose to write stories with Rosebud?
7. Did you learn anything?
8. What did you learn?
9. If you could change Rosebud, what changes would you make?
10. Which of your friends do you think would like Rosebud? Why?
11. Which of your friends wouldn't like Rosebud? Why?
12. Was using Rosebud most like 1) a game, 2) work, 3) playing?
13. Would you want to own Rosebud?
14. Would you use it over and over again?

15. How did you choose which stuffed animal to write about?
16. Did you choose the same stuffed animal each time you wrote a story, or a different one each time? Why?
17. Which stuffed animal is your favorite? Why?
18. Did you already know Winnie-the-Pooh and Eeoyre before this workshop? How?

Collaboration Comparisons (Harbor Point):

1. Did you know your partner X before working together on Rosebud?
2. How did you know her?
3. Do you two get along?
4. Which way did you like best -- with no stuffed animals, one, or two? Why?
5. Which way did you like least -- with no stuffed animals, one, or two? Why?
6. Did you get to play with it enough?
7. Who decided what to name the stuffed animal?
8. How did you decide?
9. Who decided what story to write, you or your partner?
10. How did you decide?
11. Did you feel like you got to say what should happen in the story?
12. Did you feel that you got to type as much as you wanted to?